ANNUAL REPORT

NEBRASKA

STATE BOARD OF AGRICULTURE,

FOR THE YEAR 1890.

PREPARED BY

ROBT. W. FURNAS,

SECRETARY NEBRASKA STATE BOARD
OF AGRICULTURE.

LINCOLN, NEB.:
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1891.

THE STATE BOARD OF AGRICULTURE,
OFFICE OF SECRETARY,
BROWNVILLE, NEBRASKA, February 7, 1891.

His Excellency, James E. Boyd, Governor of Nebraska:

SIR—In compliance with law in this case made and provided, I hereby transmit the annual report of the Nebraska State Board of Agriculture for the year 1890.

Very respectfully,

ROBT. W. FURNAS, *Secretary.*

PROCEEDINGS.

SEPTEMBER MEETING, 1890.

LINCOLN, NEB., September 9, 1890.

The semi-annual meeting of the Nebraska State Board of Agriculture, on order of President Greer, convened at the City Council Chamber, Lincoln, the date above written. President Greer being unwell, Vice President McDowell presided; Robt. W. Furnas, Secretary.

On roll call the following members of the State Board answered as present: R. W. Furnas, J. Jensen, E. A. Barnes, J. B. Dinsmore, M. Dunham, R. H. Henry, J. S. Hughes, A. Humphrey, Frank H. Young, J. D. Macfarland, Ed. McIntyre, J. B. McDowell, J. M. Lee, S. H. Webster, R. R. Greer, M. Doolittle, W. R. Bowen.

All members not present were, on motion, excused.

The following presidents of county societies were present as *ex-officio* members:

W. D. Wildman .... Hitchcock county.
E. Allen .... Douglas county.
R. H. Henry .... Platte county.
J. D. Ream .... Custer county.
A. D. Schwartz .... Dundy county.
R. D. McGowan .... Frontier county.
Milton Doolittle .... Holt county.
J. Jensen .... Fillmore county.

The following delegates were designated to attend the annual meetings of other associations:

The Western Fair Circuit Association, Chicago—Robt. W. Furnas.

The International Association of Fairs and Expositions, Detroit, Michigan—Robt. W. Furnas.

For each of the above, as alternate—J. D. Macfarland.

To the Fat Stock Show, Chicago—R. H. Henry, M. Dunham, and R. R. Greer.

To the Illinois State Fair, Peoria—J. B. McDowell and S. H. Webster.

American Short-Horn Association, at Chicago—J. B. Dinsmore.

In each case it was ordered that actual expenses incurred be paid by this Board.

Cherry county donated her exhibit at State Fair to the Home of the Friendless.

The Chamber of Commerce, Omaha, solicited contributions from State Fair exhibits, and from all counties in state, specimens to be placed on permanent exhibition in its hall at Omaha. Mr. Webster, superintendent Agricultural Hall, requested to advise all exhibitors and others of this request, and to urge contributions.

The Secretary was directed to issue warrants in payments of annual dues to the Western Fair Circuit Association, and the International Association of Fairs and Expositions.

It was determined to claim same dates for Fair 1891 as 1890, or to follow Iowa.

Mr. McIntyre offered the following resolution, which was adopted:

Resolved, That the Secretary be and is hereby requested to get out a circular letter, at an early day, addressed to the presidents of county societies and members, calling the attention to the very generous proposition of the Omaha Chamber of Commerce to provide space in their hall for display of agricultural products, and be requested to extend their aid and influence in securing specimen exhibits from the several counties of the state to put on exhibition there.

The President appointed as a committee to revise Rules, Regulations, and Premium List and report at annual meeting in January next: R. H. Henry, J. B. Dinsmore, Eli A. Barnes, M. Dunham, J. Jensen, R. W. Furnas.

ANNUAL MEETING, 1891.

LINCOLN, NEB., January 20, 1891.

In compliance with provisions of law in this matter provided, the Nebraska State Board of Agriculture convened in University chapel, date as above.

President R. R. Greer called the meeting to order. Robt. W. Furnas, Secretary.

On roll call the following officers were found to be present: R. R. Greer, President; J. B. McDowell, First Vice President; E. N. Grennell, Second Vice President; Robt. W. Furnas, Secretary; Austin Humphrey, General Superintendent; W. R. Bowen, Superintendent Gates; A. K. Marsh, Superintendent Police; E. McIntyre, Superintendent Art Hall and Merchants' Hall; Chas. E. Bessey, State Botanist for the Board; Lawrence Bruner, State Entomologist for the Board; L. E. Hicks, State Geologist for the Board.

The following members of the State Board answered to their names: R. W. Furnas, E. N. Grennell, J. Jensen, E. A. Barnes, J. B. Dinsmore, R. H. Henry, J. S. Hughes, W. H. Barstow, A. Humphrey, Frank H. Young, Chas. K. Lawson, J. C. Warner, J. D. Macfarland, Ed. McIntyre, J. B. McDowell, S. M. Barker, J. M. Lee, R. R. Greer, M. L. Hayward, W. L. May, R. D. McGowan, E. L. Vance, M. Doolittle, W. R. Bowen.

M. Dunham was reported absent from the state, L. A. Kent sick, and were, therefore, excused.

The following letter was read from Mr. Webster, and his resignation, under the circumstances, accepted:

"ORD, NEB., January 17, 1891.

"*Hon. Robt. W. Furnas, Secretary Nebraska State Board of Agriculture, Lincoln, Nebraska:* DEAR SIR—As it becomes necessary in my business affairs to be removed from the state of Nebraska the coming year, and as much as I regret to sever my connection with the State Board of Agriculture, at whose hands I have received so many marks of confidence and esteem, and in its welfare will ever have a great interest, seeing great success in the future to reward the patient and unremitting labor of a long list of most able men, with best of wishes, I hereby tender my resignation as a member of said Board. Very respectfully,

"S. H. WEBSTER."

The following representatives from county agricultural societies, as presidents and delegates, reported, and their credentials were referred to a committee consisting of M. L. Hayward, J. S. Hughes, and Milton Doolittle:

Adams	Isaac Boyd, President.
Antelope	L. G. Babcock, President.
Buffalo	J. T. Mallalieu, President.
Burt	R. H. Templeton, President.
Cass	Fred Gorder, President.

Clay	Chas. Hoevet, President.
Colfax	John F. Melford, Delegate.
Cuming	W. R. Artman, Delegate.
Custer	J. D. Ream, President.
Dodge	J. B. Robinson, President.
Douglas	F. J. Emerson, President.
Fillmore	J. Jensen, President.
Furnas	S. A. Jackson, President.
Gage	H. W. Parker, President.
Gosper	G. C. Jillson, President.
Greeley	P. H. Barry, President.
Hall	E. A. Barnes, Delegate.
Harlan	C. W. Rosedale, President.
Hayes	J. S. Hughes, Delegate.
Holt	Milton Doolittle, Delegate.
Howard	X. Piasecki, President.
Kearney	J. A. Cline, Delegate.
Knox	E. Ream, President.
Lancaster	J. H. Westcott, President.
Madison	T. F. Memminger, Delegate.
Merrick	S. M. Barker, Delegate.
Nemaha	Robt. W. Furnas, Delegate.
Otoe	H. Lawson, President.
Pawnee	N. O. Wright, President.
Perkins	C. H. Beaumont, President.
Platte	R. H. Henry, Delegate.
Polk	Chas. Holcomb, President.
Red Willow	C. W. Beck, Delegate.
Richardson	W. H. Davis, Delegate.
Saline	Geo. D. Stevens, President; J. H. Grimm, Delegate.
Sarpy	R. M. Carpenter, President.
Seward	A. E. Baker, President.
Thayer	J. M. Bennett, President.
Washington	E. S. Gaylord, President.
Webster	R. L. Alyea, President.
Wheeler	A. M. Kirkpatrick, Delegate.
York	J. P. Miller, President.

The Committee on Credentials submitted the following report, which was adopted:

"MR. PRESIDENT: Your Committee on Credentials has examined the list as referred, and that presidents and delegates are entitled to seats and votes as claimed, except in the matter of contest from Saline county. The committee finds that the facts in the case are exactly as they were one year ago, except that the Saline County Agricultural Society, located at Crete, held at Crete, in said county, in August, 1890, a fair of three days' duration; also, the Saline County Agricultural Society, located at Wilber, held a fair of three days' duration at Wilber, in said county, in September, 1890.

"We further find from the record of this State Board of Agriculture, that the Committee on Credentials, in a report made January 22, 1890, which report was adopted, found that the association located at Crete was duly organized in 1872, and had held a fair of at least three days' duration every year since 1872, except the year 1889, and that the president from the society at Crete was entitled to a seat in this body. We, therefore, find that Geo. D. Stevens, president of the society at Crete, is entitled to a seat as a member of this body.

"We further find, that under the new by-law adopted by this body in 1890 but one agricultural association can be recognized in one county, and but one representative admitted to a seat and a voice in the State Board.

"We, therefore, from the facts and under the by-laws, very reluctantly find that Mr. Grimm, president of the society at Wilber, is not entitled to a seat as a member of this body.

M. L. HAYWARD.
"JOHN S. HUGHES.
"MILTON DOOLITTLE."

Chas. E. Bessey, chancellor of the State University, then extended welcome to the Board, which was responded to by President Greer.

PRESIDENT'S ANNUAL ADDRESS.

President Greer then delivered his annual address, as follows:

Gentlemen of the Nebraska Agricultural Society: It is well known to every intelligent person that the agricultural interests of a state underlies the prosperity and advancement of a country, and that every other interest moves in response. Our agricultural products have much to do, not only with the reputation of the different states, but of the market value of the whole world. Show me a country anywhere under a high state of cultivation and I will show you a country with all the other enterprises of civilization, wealth, and happiness.

We are truly proud of Nebraska and the high position the state occupies, not only in regard to the immense quantities of wheat, oats, and corn raised, but in the quality of fine blooded stock which is bred and raised within our borders. She to-day commands the admiration of the whole country, and as a new state Nebraska stands second to none in the union. This result is largely due to you who are assembled here to-day.

It would seem, when we view the various specimens of fine stock, the endless variety of farm products, fruit, and mechanical handiwork at our State Fair, that we had arrived at such a degree of perfection that nothing more was possible or even desirable. And then, when another year rolls around, something new and even more wonderful is presented to our wondering eyes. And so we go on from year to year, and so we should go on until the ultimate limit of perfection is attained, if such a thing is ever to be. It is for the purpose of stimulating and hastening this constant progress that fairs are held and are to be commended.

In your capacity as representatives of the agricultural and general industrial interests of our state, it is your duty at this meeting to look carefully over the work done by your representatives placed by you in the immediate charge of the work of this Board, and to make such suggestions and formulate such rules as in your judgment are necessary, in order that the greatest possible good to the greatest possible num-

ber may result. It is your love for and interest in this kind of work that has placed you in a position to be elegible to a membership here. It is not too much, then, to expect intelligent and progressive work done by you.

Notwithstanding it has been a national by-word that the year 1890 was an "off year," and that every branch of business or enterprise, known to the people of this country, would and must suffer, your Board of Managers, viewing the situation early in the season and having the counsel and invaluable support of the grandest and most efficient secretary in fair work, ex-Governor R. W. Furnas, and knowing that Nebraska had more generous, big-hearted farmers than any state west of the rising sun, felt assured that our last exhibition must and would be a grand success. And true it was; you can return to your homes and say truthfully that Nebraska still stands at the head of the agricultural column.

We now have a great work of reponsibilty before us, and one of the grandest opportunities that has ever been presented to the people of the nineteenth century, not only to present to the whole world the rich agricultural resources, the fine blooded stock, and the manufacturing advantages of our great and young Nebraska, but to give her a record that will be a part in national history, a record that will be a guide to generations to come, a record that will be read and re-read with pride by your children and by their children after you, who represent their interests to-day are laid away to sleep the long, long sleep.

It is your duty to aid and assist in making the World's Columbian Exposition to be held in Chicago, Ill., in 1893, a grand success. You thus, in my judgment, have a double duty to perform, not only as a citizen of America, but as citizens of Nebraska.

I recommend that you each use your influence with the different representatives now in the legislature, urging that a bill for an appropriation not less than $150,000, or as much thereof as may be required, to enable Nebraska in placing a complete exhibit of all her valuable resources at the Columbian fair in Chicago during the year 1893.

Now, at the close of another year, before I leave this chair, I feel it a duty, as well as a privilege, to extend my sincere thanks to you as a Board for your hearty support; to the Board of Managers especially for their untiring kindness. I think no organization could carry on so great a work with greater harmony and good will.

I want to thank the citizens of Lincoln, in behalf of this Board as well as personally for myself. Every promise made by them has been kept.

I wish each of you and your families a happy and a prosperous new year. I thank you, gentlemen, for your kind attention.

TREASURER'S REPORT.

Mr. President, and Gentlemen of the State Board of Agriculture: As Treasurer, I herewith submit for your consideration the financial report for the past year. The items of receipts I give you in detail, as it devolves upon me more than any other to furnish them. The items of expenses and premiums paid are so fully and clearly presented by our worthy Secretary's report that I will not again present them in detail. I therefore give you the amount of disbursements *in toto*.

RECEIPTS.

1890.			
Jan.	22.	To balance	$8777 20
Feb.	18.	Error warrant No. 59, 1889	13 25
	18.	Balance corn exhibit	1 03
	18.	Horticul. ex. corn exhibit	8 75
Sept.	13.	General admission tickets	12455 50
	13.	Amphitheatre tickets	2736 25
	13.	Quarter stretch tickets	928 50
	13.	Booth privileges	3850 00
	13.	Hack stands	494 00
	13.	Camp permits	169 50
	13.	Supply wagons	50 00
	13.	Forage per cent	468 65
	13.	Speed money	4269 80
	13.	Stall rents	911 50
	13.	Speed fines	197 50
	13.	State apportionment	2000 00
	13.	B. & M. coupons	6931 50
	13.	U. P. coupons	1595 00
	13.	M. P. coupons	986 50
	13.	F., E. & M. V. coupons	1211 00
	13.	St. Paul coupons	23 00
	13.	California Buggy Company	112 50
	13.	Freight repaid	1 15
	13.	A. S. B. premiums	150 00
	13.	Score cards	75 00
	13.	Programmes	50 00
	13.	Add on wagon	20 00
	13.	1889 warrants	7 00
	13.	Add in premium list	271 25
		Total	$48755 33

EXPENDITURES.

Total amount of warrants paid to date		$35333 08
Warrants paid of 1889, No. 333	$8 00	
Warrants paid of 1889, No. 457	2 00	
Warrants paid of 1889, No. 602	2 00	
Warrants paid of 1889, No. 611	1 00	
Warrants paid of 1889, No. 614	2 00	
Warrants paid of 1889, No. 670	1 00	
Warrants paid of 1889, No. 684	1 00	17 00
Total		$35350 08
Balance on hand in treasury January 20, 1891		13405 25
Total		$48755 33

All warrants and vouchers paid, and for which I ask credit at your hands, are herewith submitted and made a part of this report. All of which is respectfully submitted.

LEWIS A. KENT, *Treasurer.*

The following warrants for 1890 not paid:

No. 182	$8 75
No 200	35 00
No. 320	5 00
No. 323	5 00
No. 341	1 50
No. 427	4 00
No. 494	1 00
No. 519	2 40
No. 535	1 50
No. 642	2 00
No. 648	50
No. 669	2 40
No. 687	1 00
No. 689	1 00
No. 777	1 00
Total	$72 05

Total amount of money received		$48755 33
Warrants paid for 1890	$35333 08	
Warrants paid for 1889	17 00	
Error in warrant No. 368 of 1890	1 00	35351 08
Balance on hand January 20, 1891		$13404 25

L. A. KENT, *Treasurer.*

SECRETARY'S REPORT.

MR. PRESIDENT: I hereby submit the annual report of the Secretary of the Nebraska State Board of Agriculture. In this report is shown the number of each warrant drawn, its date, amount, for what purpose, and under what authority issued, accompanied with a detailed, itemized voucher for each, to which careful attention is urgently invited.

As it is voluminous, embracing a list of near 1,000 warrants, and as it will go into the hands of the Auditing Committee, with your permission I will dispense with reading it, and instead, which will, I think, prove more satisfactory to all present, present a classified summary.

The total assets for the year 1890 were, $48,755.38. This includes the balance over from the last year, $8,777.20, and the amount of state appropriation, $2,000. Actual cash receipts of the fair, $37,978.18. There was paid for premiums awarded, $13,669.73. Other accounts, as hereinafter detailed, $21,744.75. Actual profits of the year, above its expenditures, $2,563.70.

Improvements and expenses of grounds, expenses of fair and all connected attendants, $9,689.37—This account included lumber, permanent improvements on grounds not provided by the Nebraska Exposition Association, hardware, painting, switching cars, pay rolls of police, gate keeper, labor, all clerks during fair, supplies for all of the halls, all experts, judges, and their expenses, cleaning up grounds, sprinkling, ice, new refrigerator, carpenter's work, expenses winter corn exhibit, speed starter, attractions, engineer, coal, pay of class superintendents, sawdust, cartage, plumbing, and the like.

Stationery, printing, and advertising, $3,372.31—This embraces printing 15,000 copies Premium List, 5,000 large and 8,000 small illustrated hangers, typewriter, all stationery and supplies for all the offices and officers and Board of Managers, advertising, expenses of traveling canvassers, and bill posters, novelty cards and medals, authors' pages, entry books, warrant books.

Postage, $791.08—This includes postage for all purposes, letters, circulars, diplomas and medals sent out and annual reports distributed. But for the fact that all express companies in the state carry small parcels, advertising hangers, and reports free, which would otherwise have to pass through the mails, this item of expense would have been the past year, $2,373.24.

Freight, express, and telegrams, $459.76—This is for the whole expense in this line for the whole year. Owing to the liberality of the railroads, express, and telegraph companies, this item of expense is but a mere fraction of what it would otherwise be.

Hotel bills, $965.05—Which includes the hotel bills of all members of the State Board at winter meeting; that of the Board of Managers for the entire year; guests from other state associations during State Fair, and meals of committees and judges serving otherwise free during fair days.

Livery, $111—This expenditure was for horses furnished superintendents during fair in the discharge of official duties; transportation to and from the grounds for committees serving without compensation, guests from other state societies, and other work connected with the fair.

Forage, $786.39—In the matter of forage we received in payments from exhibitors $468, thus reducing the net cost of this item to $318.39.

Salaries, $3,450—This includes the salaries fixed by the constitution for president, treasurer, board of managers, and secretary.

Miscellaneous, $2,119.29 — This includes $1,000 paid annually to the State Horticultural Society; annual appropriations to the state botanist, geologist, and entomologist for the Board; State Poultry Association; transportation to parties accompanying county collective exhibits; expenses of delegates to other state, district, and international associations; removal of library, and fitting of the Board's new rooms in the capitol building; speed books and supplies; photos of grounds to send abroad; transportation of winter corn exhibit to New York and packing same; writing up diplomas, and other items of similar character.

The balance on hand to date, as shown, is $13,340.90. There is, of speed money awarded, tied up under protest, the sum of $370, and yet to be paid, when the American Trotting Association determines to whom it shall be paid. This will reduce the balance to $12,970.90.

To date of this report I have not sufficient data as to the crops of 1890 to present even an approximate statement. But few reports from the county associations have yet been received. It is a well known fact, however, that the corn crop in particular in Nebraska the past year, in matter of yield per acre, the state over, was never so short. The acreage planted was largely increased, and the increase in price over any late season contributes materially and largely to the aggregate value of the corn crop of the state for the year, rendering the total value higher than we have ever before had.

Referring to the annual reports from county societies. Under the present regulations these reports are due December 31 of each year. There is no good reason

why they cannot be as well made December 1 as 31. This would enable your Secretary to present at least an approximate report at the annual meetings. I respectfully suggest the Board make the indicated change in this respect.

Nothwithstanding the unusually adverse environments, it is safe to say the Nebraska State Fair and Exposition for 1890 far excelled any of its predecessors. Especially was this marked as to agricultural products direct from the soil, that in which all are so deeply concerned. This was generally conceded by all. It was as much a surprise to our own people as to non-resident visitors, for all of which the Board has reasons for congratulations.

As the state grows, and fairs enlarge, there is a demand for an increase in the scope of premiums offered. Especially is this so as to live stock. At the late meeting of the Western District Fair Association, held in Chicago, November 18, a committee of one from each state represented reported a new list for live stock premiums, enlarging the number in each class, as well as looking more to uniformity in the several classes. This will result in better attendance of exhibitors, which in some respects has been on the decline for the past few years. This new schedule is submitted for your consideration and I trust approval.

The excess in expenditure above that paid for premiums has received somewhat unfavorable criticism. This is purely from lack of a knowledge of facts in connection with all fairs and expositions, from that of a county organization up through state, national, and international exhibits. Few fairs, and none of any magnitude, but what other expenses are far more than the premiums paid. To those conversant, in the very nature of things, it cannot be otherwise. A comparison of our work with that of other states shows our premiums proportionately larger and expenses much less than others. But besides, and over and above the mere dollars and cents paid premiums, stand other and more important fair factors. By far the greater portion of those who attend these annual gatherings are not exhibitors competing for money awards. Fairs are grand gala-days of the year, when the old and the young meet in annual concourse for recreation, benefit, and amusement, if you please. The educational features of fairs and expositions are becoming more prominent and pronounced each year as the world moves onward. All these are of value largely in excess of money paid as premiums. The public demand and appreciate, and good management provide in these lines of work.

In connection with the matter of premiums, permit again brief reference to the speed class. Unwarranted adverse criticism has been exercised in that $6,000 is set aside by this Board for this purpose, and particularly that two of the purses the past year were $1,000 each. Allow me to state that the entrance fees in those two $1,000 purses was $175 more than the money paid to the winners, thus leaving a net profit of that sum in the two purses. In fact, considering all direct incomes, there was a handsome net profit last year on the whole speed class, more money being received than was paid out, as the following brief summary will show:

The Board offered for speed premiums	$6000 00	
The Board paid for speed premiums		$5865 00
The Board paid starter		203 00
The Board paid judges and superintendents		112 00
The Board paid gate keepers		12 00
Paid advertising and speed printing		234 00
Total		$6426 00

The receipts for speed were:

Entrance fees	$4252 30	
Stall rent	252 00	
Amphitheatre	2736 25	
Quarter stretch	928 50	
		$8169 05
Net profit in speed class		1743 05

I am pleased to announce further in this connection, that every fine and penalty imposed on the track at our last meeting of the State Fair has been collected and paid into the treasury.

The annual report for 1889 was out and circulated in good season. It is regarded of more than ordinary value, as especially evidenced by the unusual demand for it, both at home and abroad. The "Catalogue of the Flora of Nebraska," the "Sugar Beet Industry," "Geology in its Relation to Agriculture," and the "Compilation of the Rainfall of Nebraska from the Year 1853 to 1889," are rare papers and of permanent value. These reports have been distributed as indicated in my last annual report, and thus given a wide distribution.

The corn exhibit of last winter, which was shipped for exhibition at Edinburg, Scotland, and Vienna, Austria, I am advised reached the points of destination safely and in fine condition. Its exhibition at both these foreign points was with marked good results, even better than in Paris the preceding year. I am flattered with the belief that we have had no better advertisement of this, one of our leading products. I have in contemplation a similar advertising disposition of the exhibit now in place. With your permission, and that of the exhibitors, I will place it where it will serve a good purpose. The same gentleman, Colonel Murphy, who handled so well our corn exhibit for 1889, will continue his work advertising us abroad with the exhibit of 1890, if we can have it. If we deliver it in New York, he will pay ocean and foreign transportation himself, and conduct the exhibit at his own expense. I ask permission to so dispose of the present exhibit, with an appropriation to box, pack, and transport to New York.

Since our last annual meeting the committee appointed for that purpose has obtained a suite of three rooms on the first floor in the new state capitol building. One room, with the appropriation made by this Board at its last meeting, has been shelved for a library and the books put in place. Attached to the smaller room, designated as the office, is a large and commodious fire-proof vault, in which the archives and more valuable books and papers of the Board have been placed. The three rooms are carpeted, fitted with appropriate furniture, heated with hot air, and lighted with gas. On the walls of the main building are placed the fine collection of the photo views of the state exhibit at New Orleans.

In this connection, I most urgently suggest that the leading factor in these State Board of Agriculture headquarters be the conversion of the large main room into a permanent state agricultural museum, to consist of a collection from each county in the state, of all imperishable products, such as soils, grains, seeds, etc. To this end I have, at my individual expense, prepared and put in place a sample case of what I would like to see there for each of the counties in Nebraska. This case contains thirty-two half gallon glass inverted exhibition jars, made especially for such use. The cost of cases, jars, and sealing corks, in quantities to supply each

organized county in the state, will not exceed the sum of $25 for each. An appropriation for this purpose should be made by the legislature.

The Board has, for several years past, had taken large photo views of the principal features or exhibits of the State Fairs. These should be framed and put in place in these rooms.

Since our last annual meeting, the World's Columbian Fair has been located at Chicago—at our very door. I beg leave to again call renewed attention to this time and place when, and where Nebraska can and ought to place before the world her unexcelled products, resources, and possibilities, that, as an advertisement, if nothing more, she may invite capital and population to join with us in our onward march. This Board should lead off in the enterprise and inaugurate plans and modes by which we keep pace with the sisterhood of states, as well as maintain our reputation for good works in that line.

To the railroads, express companies, and the press we are more than ordinarily indebted for fair success the past year. But for their unprecedented liberality and encouragement, success would not have attended the efforts of the Board. The situation was comprehended by all concerned, and then the "will brought about the way."

In conclusion: As is now well known to all members of this Board, many farmers in the newer counties of the western portions of Nebraska, by reason of the drouth and hot winds prevailing the past season, are in want. They are those with whom and for whom this organization labor. They have, from year to year of late, contributed liberally their time and products as exhibitors, to render our annual expositions successes. As we have been peculiarly fortunate in our work the past year, showing a handsome balance, I most respectfully suggest that this Board cannot make a more useful and appropriate use of $1,000 than to contribute it to the state relief fund for the benefit of the western farming interests now in need of aid.

ROBT. W. FURNAS, *Secretary*.

LIST OF WARRANTS, 1890.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Jan. 23	J. H. Westcott	1	Hotel bill		$4 00
Jan. 23	P. H. Barry	2	Hotel bill		4 00
Jan. 23	S. H. Webster	3	Hotel bill		4 00
Jan. 23	A. A. Carman	4	Hotel bill		2 00
Jan. 24	Capital Hotel	5	Hotel bill		51 00
Jan. 24	H. R. Nissley & Co	6	Muslin		7 17
Jan. 24	F. H. Young	7	Posting bills, 1889		15 00
Jan. 24	F. H. Young	8	Superintendent Corn Show		35 00
Jan. 24	R. W. Furnas	9	Extra clerk hire, 1889		117 00
Jan. 24	Windsor Hotel	10	Hotel bill		383 05
Jan. 25	Grand Island Times	11	Advertising State Fair		5 00
Jan. 25	S. C. Bassett, State Dairymen's Ass'n	12	Aid Chicago Butter Show		62 50
Jan. 25	Omaha Bee	13	Advertising State Fair		5 00
Jan. 25	Telegram (Columbus)	14	Advertising State Fair		5 00
Jan. 25	Omaha Republican	15	Advertising State Fair		2 85
Jan. 25	R. W. Furnas	16	Sundries (see bill)		27 10
Jan. 25	Lillibridge & Roose	17	Writing diplomas		8 00
Jan. 25	State Journal Co	18	Secretary supplies		56 00
Jan. 25	R. W. Furnas	19	Cash paid hotel bills for members		11 00
Jan. 25	H. Larson	20	Hotel bill		3 00
Jan. 25	Lindell Hotel	21	Hotel bills		16 50
Jan. 27	Lincoln News	22	Advertising Fair		7 25
Feb. 6	John Sigerson	23	Premiums	$24 00	
Feb. 6	W. H. Barstow	24	Services ass't sec'y, winter meeting		5 00
Feb. 6	C. E. Wiester	25	Fgt., tel., and ex., Jan		7 97
Feb. 6	W. A. Judkins	26	Postage, Jan		17 02
Feb. 7	Jared G. Smith	27	Expert, Corn Show		16 00
Feb. 7	A. M. Troyer	28	Expert, Corn Show		18 00
Feb. 7	A. Rogy	29	Premiums	16 00	
Feb. 8	Lincoln Paper House	30	Paper to pack corn		2 80
Feb. 8	Henry & Coatsworth	31	Rent lumber, Corn Show		3 50
Feb. 8	John McIntosh	32	Print score cards for corn		2 00
Feb. 8	G. P. Thurber	33	Lumber and making houses for corn		14 00
Feb. 8	H. E. Noble	34	Corn photos		20 00
Feb. 11	Red Willow County Agricultural Society	35	Corn premiums	12 00	
Feb. 11	Geo. A. Slayton	36	Corn premiums	28 00	
Feb. 11	Logan Co. Agr. Soc	37	Corn premiums	20 00	
Feb. 11	Budd Jones	38	Corn premiums	4 00	
Feb. 11	O Nelson	39	Corn premiums	8 00	
Feb. 11	Harry Seltz	40	Corn premiums	4 00	
Feb. 11	John W. Hawkins	41	Corn premiums	20 00	
Feb. 11	A. P. Seymour	42	Corn premiums	4 00	
Feb. 11	H. C. Taylor	43	Corn premiums	4 00	
Feb. 11	R. Hogue	44	Corn premiums	8 00	
Feb. 11	M. H. Smith	45	Corn premiums	28 00	
Feb. 11	Lee Smith	46	Corn premiums	16 00	
Feb. 11	C. B. Smith	47	Corn premiums	8 00	
Feb. 11	U. Cachlin	48	Corn premiums	8 00	
Feb. 11	J. D. Ream	49	Corn premiums	4 00	
Feb. 18	State Poultry Ass'n	50	State Board appropriation		100 00
Feb. 21	T. H. Benton	51	Copying statistics		10 00
Feb. 22	D. T. Cook	52	Boxes corn to Vienna		16 90
Feb. 22	Gibson, Miller & Richardson	53	1,000 warrant books		4 50
Feb. 22	Nebraska Farmer	54	Corn score slips		7 50
Feb. 22	Call Publishing Co	55	500 slips		2 50
Mar. 7	C. E. Wiester	56	Fgt., ex., and tel., Feb		13 84
Mar. 7	W. A. Judkins	57	Postage, Feb		18 55
Mar. 7	M. Scott	58	Fgt. corn to New York		19 45
Mar. 14	A. Palmer	59	Prems. 1889—duplicate No. 693, '89	4 00	
Mar. 18	R. W. Furnas	60	First quarter salary		500 00
Mar. 22	Lillibridge & Roose	61	Engrossing McIntyre resolution		5 00
Mar. 28	T. F. Mamminger	62	Hotel bill, winter meeting		3 00
April 2	L. Bruner	63	Ent'l report		10 00
April 8	W. A. Judkins	64	Postage, March, '90		8 49
April 8	C. E. Wiester	65	Ex., tel., and fgt., March, '90		11 74
April 8	Brownville News	66	Printing circulars		1 00
April 16	Nebraskan, Hastings	67	Advertising location of fair		5 00
April 17	Am. Trotting Ass'n	68	Annual dues and supplies		79 00
April 25	E. N. Sherrill	69	Refunded stall money		20 00
April 29	L. Bruner	70	Electrotype		5 00

LIST OF WARRANTS, 1890—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
May 8	Apthorp Bros	71	Printing		$2 25
May 8	Hall & O'Donald	72	Printing speed programme		21 60
May 8	W. A. Judkins	73	Postage, April, '90		6 60
May 8	Lincoln News Co	74	Advertising		5 15
May 8	C. E. Wiester	75	Ex., tel., and fgt., April, '90		15 35
May 24	Cussons, May & Co	76	Blotters		36 00
May 26	C. E. Wiester	77	Freight, library		30 41
May 26	R. W. Furnas	78	Expense removing library		23 75
May 26	C. E. Wiester	79	Ex., tel., and fgt., May, '90		7 60
June 2	W. A. Judkins	80	Postage, May, '90		76 17
June 2	Robt. W. Furnas	81	Second quarter's salary		500 00
June 2	C. E. Wiester	82	Fgt., tel., and ex., May 17 to 31		13 57
June 14	Egbert T. Sess	83	Railroad guide		5 00
June 16	Chas. E. Bessey	84	Botany appropriation		15 00
June 23	C. E. Wiester	85	Fgt., tel., and ex., June 1 to 16		18 79
June 23	R. W. Furnas	86	Extra clerk hire, Jan. 1 to July 1		300 00
June 23	Windsor Hotel	87	Hotel bill		120 25
June 25	Paxton Hotel	88	Hotel bill		11 50
July 5	W. A. Judkins	89	Postage, June, '90		5 35
July 5	C. E. Wiester	90	Ex., tel., and fgt., June 16 to 31		14 60
July 5	Geo. P. Rowell & Co	91	Directory		3 00
July 11	Den. Man'g Co	92	Gum tags and paper		1 05
July 11	L. E. Hicks	93	Geologist appropriation		100 00
July 15	W. R. Dawes & Co	94	Insurance, '90 to '95		280 00
July 15	Ezra Cook	95	Tickets		33 50
July 15	F. E. Brown	96	Expense Swine Supt		11 60
July 15	Apthorp Bros	97	Printing		4 75
July 15	R. W. Furnas	98	Sundries (see bill)		10 90
July 19	Merchants' Transfer	99	Cartage, library		3 00
July 25	F. E. Gage	100	Novelty cards		20 25
July 25	Cossack & Co	101	Novelty cards		63 35
July 31	Cent. Show Print Co	102	Horse and dog bills		20 00
Aug. 2	W. A. Judkins	103	Postage, July, '90		47 78
Aug. 11	Fair Publishing Co	104	Printing tickets		42 65
Aug. 11	Crete Chautauqua	105	Advertising		20 00
Aug. 11	Apthorp Bros	106	Printing		13 75
Aug. 11	C. E. Wiester	107	Ex., tel., and fgt., July, '90		42 87
Aug. 11	W. H. Warner & Bro	108	Medals (500)		125 00
Aug. 11	A. T. Gruetter & Co	109	Library shelves		240 00
Aug. 18	L. A. Kent, Treas	110	Tilden protested check		52 50
Aug. 25	W. D. Mann	111	Labor pay roll, work on refrigerator		325 00
Aug. 25	Standard Turning Co	112	Wagon tank and seat		12 00
Sept. 1	H. C. Smith	113	Oats		74 95
Sept. 2	John Roberts	114	Repairing sprinkler		16 00
Sept. 4	Stover & Folby	115	Painting		89 50
Sept. 4	Stover & Folby	116	Painting numbers		10 00
Sept. 8	W. H. H. Clark	117	Labor on grounds		1 50
Sept. 9	F. Lassen	118	Watchman		8 50
Sept. 9	E. Fisher	119	Labor		8 75
Sept. 10	E. O. Miller	120	Hay		17 25
Sept. 11	Alex. Legge	121	Expert		37 75
Sept. 11	F. M. Welchel	122	Horse expert		35 00
Sept. 11	Custer Co. Agr. So	123	Premiums	$200 00	
Sept. 11	York Co. Agr. So	124	Premiums	160 00	
Sept. 11	Douglas Co. Agr. So	125	Premiums	120 00	
Sept. 11	Cuming Co. Agr. So	126	Premiums	100 00	
Sept. 11	Brown Co. Agr. So	127	Premiums	80 00	
Sept. 11	Holt Co. Agr. So	128	Premiums	60 00	
Sept. 11	Burt Co. Agr. So	129	Premiums	40 00	
Sept. 11	W. Z. Hickman	130	Expert		39 80
Sept. 11	Oltman Bros	131	Premiums	68 00	
Sept. 11	La Veta Jersey Cattle Co	132	Premiums	59 00	
Sept. 11	J. W. Dean	133	Premiums	14 00	
Sept. 11	B. O. Cowan	134	Premiums	32 00	
Sept. 11	R. W. Blake	135	Superintendent		25 00
Sept. 11	Holderbaum Bros	136	Premiums	42 40	
Sept. 11	Joseph Watson & Co	137	Premiums	24 00	
Sept. 11	J. C. Thrailkill	138	Premium	44 00	
Sept. 11	J. H. Spear	139	Expert		32 50
Sept. 11	M. E. Moore	140	Expert		38 35
Sept. 11	C. C. Wright	141	Premiums	20 00	

LIST OF WARRANTS, 1890—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Sept. 12	Householder & Baughman	142	Premiums	$464 00	
Sept. 12	W. Z. & G. W. Swallow,	143	Premiums	16 00	
Sept. 12	Gilfillan & Murray	144	Premiums	76 00	
Sept. 12	Current & Sanderson	145	Premiums	48 00	
Sept. 12	H. E. Yeomans	146	Premiums	32 00	
Sept. 12	L. B. Wilson	147	Premiums	29 00	
Sept. 12	L. B. Wilson	148	Premiums	27 00	
Sept. 12	W. W. Seeley	149	Premiums	46 40	
Sept. 12	H. C. Reynolds	150	Premiums	8 00	
Sept. 12	David McKay	151	Premiums	144 00	
Sept. 12	C. H. Elmendorf	152	Premiums	89 50	
Sept. 12	C. H. Elmendorf	153	Premiums	6 50	
Sept. 12	C. F. Stone	154	Premiums	256 00	
Sept. 11	C. F. Stone	155	Premiums	8 00	
Sept. 11	Ed. Pyle	156	Premiums	148 00	
Sept. 11	Ed. Pyle	157	Premiums	18 00	
Sept. 11	W. P. Hayzlett	158	Premiums	4 00	
Sept. 11	F. S. Greene	159	Premiums	24 00	
Sept. 11	M. R. Stanley	160	Premiums	20 00	
Sept. 11	M. R. Stanley	161	Premiums	12 00	
Sept. 11	J. Evans & Son	162	Premiums	32 00	
Sept. 11	Geo. Correvan	163	Premiums	50 00	
Sept. 11	S. S. Borton	164	Premiums	30 00	
Sept. 11	D. C. Clapp	165	Premiums	15 00	
Sept. 11	Trinder & Bailey	166	Premiums	8 00	
Sept. 11	Roberts Bros	167	Premiums	31 20	
Sept. 11	J. W. Dean	168	Premiums	6 40	
Sept. 11	J. W. Dean	169	Premiums	10 00	
Sept. 11	M. M. Coad	170	Premiums	140 00	
Sept. 11	M. M. Coad	171	Premiums	70 00	
Sept. 11	Makin Bros	172	Premiums	240 00	
Sept. 11	Wm. Robertson	173	Premiums	16 00	
Sept. 11	R. J. Wheeler	174	Starter races		$203 00
Sept. 11	J. M. Lee	175	Superintendent		40 00
Sept. 11	John Goslin	176	Expert		73 00
Sept. 11	John S. Hughes	177	Superintendent		35 00
Sept. 11	S. H. Webster	178	Superintendent and expenses		61 40
Sept. 11	E. A. Park	179	Assistant superintendent		20 00
Sept. 11	S. J. Bateman	180	Assistant superintendent		20 00
Sept. 13	Alex. Stephens	181	Superintendent		41 80
Sept. 13	E. Fisher	182	Labor		8 75
Sept. 13	J. B. McDowell	183	Services Fair 1890		25 00
Sept. 13	C. H. Barnard	184	Clerk		30 00
Sept. 13	G. F. Warren	185	Clerk		30 00
Sept. 13	W. W. Watson	186	Clerk		40 00
Sept. 13	F. E. Brown	187	Superintendent and expenses		78 85
Sept. 13	S. C. Bassett	188	Superintendent and expenses		57 40
Sept. 13	F. S. Fulmer	189	Committee service		13 15
Sept. 13	Wm. Sutton	190	Committee work		11 40
		191	Canceled.		
Sept. 13	V. A. Lally	192	Clerk, Fair '90		9 00
Sept. 13	Mr. Stiles	193	Clerk, Fair '90		9 00
Sept. 13	C. H. Heffler	194	Clerk, Fair '90		9 00
Sept. 13	S. C. Fisk	195	Clerk, Fair '90		9 00
Sept. 13	M. Shaffer	196	Clerk, Fair '90		6 00
Sept. 13	Al. Potter	197	Assistant speed		6 00
Sept. 13	Homer Honeywell	198	Clerk and messenger		26 00
Sept. 13	Fred Cooley	199	Clerk, Fair '90		6 00
Sept. 13	J. S. Hughes	200	Class superintendent		35 00
Sept. 9	R. M. Whitaker	201	Speed	7 50	
Sept. 9	Diamond Horse Co	202	Speed	87 50	
Sept. 9	G. I. Landon	203	Speed	25 00	
Sept. 11	H. Pickrell	204	Speed	10 00	
Sept. 10	H. Pickrell	205	Speed	227 50	
Sept. 10	D. T. Sabin	206	Speed	37 50	
Sept. 10	Thomas Moore	207	Speed	100 00	
Sept. 10	C. A. Bennett	208	Speed	60 00	
Sept. 10	H. Pickrell	209	Speed	5 00	
		210	Void.		
Sept. 11	H. Pickrell	211	Speed	2 50	
Sept. 11	G. I. Landon	212	Speed	5 00	
Sept. 11	Joseph Powell	213	Speed	10 00	

LIST OF WARRANTS, 1890—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Sept. 11	J. Ward	214	Speed	$30 00	
Sept. 11	Wm. Huston	215	Speed	60 00	
Sept. 11	A. W. Fisher	216	Speed	10 00	
Sept. 11	Diamond Horse Co	217	Speed	200 00	
Sept. 11	I. J. Smith	218	Speed	200 00	
Sept. 11	P. McEvoy	219	Speed	100 00	
Sept. 11	S. W. Lockwood	220	Speed	60 00	
Sept. 11	Nat. Bruen	221	Speed	500 00	
Sept. 11	Miller & Cooke	222	Speed	100 00	
Sept. 11	Frank Burrus	223	Speed	200 00	
Sept. 11	E. D. Gould	224	Speed	30 00	
Sept. 11	M. J. Jones	225	Speed	100 00	
Sept. 11	E. D. Gould	226	Speed	52 50	
Sept. 11	M. J. Jones	227	Speed	62 50	
Sept. 11	Wm. Huston	228	Speed	60 00	
Sept. 12	G. L. Maxwell	229	Speed	10 00	
Sept. 12	G. L. Maxwell	230	Speed	90 00	
Sept. 12	Ed. Pyle	231	Speed	143 00	
Sept. 12	Ed. Pyle	232	Speed	332 00	
Sept. 12	A. W. Fisher	233	Speed	45 00	
Sept. 12	R. T. Kneebs	234	Speed	500 00	
Sept. 12	C. A. McCargar	235	Speed	6 00	
Sept. 12	C. A. McCargar	236	Speed	94 00	
Sept. 12	G. I. Landen	237	Speed	60 00	
Sept. 12	C. A. Bennett	238	Speed	90 00	
Sept. 12	A. J. Hale	239	Speed	250 00	
Sept. 12	W. J. Emig	240	Speed	200 00	
Sept. 12	Frank Taylor	241	Speed	75 00	
Sept. 12	Joseph Powell	242	Speed	7 50	
Sept. 12	W. A. Paxton, Jr	243	Speed	200 00	
Sept. 12	Perry Bros. & Warner	244	Speed	100 00	
Sept. 12	C. A. Bennett	245	Speed	45 00	
Sept. 12	G. I. Landon	246	Speed	22 50	
Sept. 12	Johnson & Perry	247	Speed	75 00	
Sept. 12	Mat. Williams	248	Speed	30 00	
Sept. 12	L. C. Judy	249	Speed	150 00	
Sept. 12	Charles Stewart	250	Speed	60 00	
Sept. 12	Wm. Weaver	251	Driving horse Eli		$5 00
Sept. 12	Wm. Weaver	252	Helpers, horse Eli		5 00
Sept. 12	R. R. Greer	253	Band		200 00
Sept. 12	Thomas Moore	254	Speed	100 00	
Sept. 12	D. T. Mount	255	Expense, speed		34 40
Sept. 13	Beauchamp & Jarvis	256		40 00	
Sept. 13	Beauchamp & Jarvis	257	Speed	45 00	
Sept. 13	H. C. Smith	258	Speed	40 00	
Sept. 13	Henry Fry	259	Premium	8 00	
Sept. 13	S. J. Odell	260	Premium	8 00	
Sept. 13	Geo. Putnam	261	Sprinkling		76 20
Sept. 13	Kendall & Smith	262	Forage		98 50
Sept. 13	T. W. Lowrey	263	Forage		39 60
Sept. 13	Alliance Pub. Co	264	Advertising		5 25
Sept. 13	E. Gillespie	265	Clerk to Secretary		36 00
Sept. 13	W. U. Telegraph	266	Telegraphing		13 50
Sept. 13	Telephone Co	267	Service on Fair grounds		40 00
Sept. 13	C. D Jensen	268	Assistant Art Hall		27 00
Sept. 13	H. Coatsworth & Co	269	Lumber		448 67
Sept. 13	H. Gibson	270	Printing		85 00
Sept. 13	Mrs. S. C. Langworthy	271	Superintendent class		50 00
Sept. 13	A. B. Alling	272	Assistant Art Hall		5 00
Sept. 13	Ed. McIntyre	273	Superintendent Art Hall		50 00
Sept. 13	A. Humphrey	274	Express paid		50
Sept. 13	G. F. Hickman	275	Speed clerk		60 00
Sept. 13	W. D. Mann	276	Labor pay roll		233 00
Sept. 13	Blodgett & Ludwig	277	Repairs Fish House		48 50
Sept. 13	O. R. Nelson	278	Refund		25 00
		279	Canceled.		
Sept. 13	Lincoln Ice Co	280	Ice		106 96
Sept. 13	Hutchins & Hyatt	281	Sawdust and safe		103 00
Sept. 13	Humphrey Bros	282	Hardware		90 00
Sept. 13	S. M. Barker	283	Booth		575 25
Sept. 13	R. H. Oakley	284	Coal		8 35
Sept. 13	F. A. Graham	285	Livery		4 00
Sept. 13	Transfer Co	286	Cartage		1 75
Sept. 13	W. A. Bohanan	287	Livery		16 00

LIST OF WARRANTS, 1890—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Sept. 13	Mrs. Oppenheimer	288	Supplies		$1 50
Sept. 13	Geo. G. Furnas	289	Clerk to Secretary		102 00
Sept. 13	Wessel Printing Co.	290	Printing		54 60
Sept. 13	J. C. Woempener	291	Barrels		5 00
Sept. 13	W. P. McCreary	292	Speed judge		13 00
Sept. 13	G. W. Sisson	293	Labor		23 25
		294	Canceled.		
Sept. 13	State Journal Co.	295	Printing and supplies		2745 65
Sept. 13	D. T. Mount	296	Superintendent speed		50 00
Sept. 13	Henry Fry	297	Speed judge		16 50
Sept. 13	Mrs. E. W. Miller	298	Class superintendent		50 00
Sept. 13	Neb. Planing Mill Co.	299	Lumber		180 60
Sept. 13	H. J. Hendricks	300	Speed judge		10 00
Sept. 12	W. D. Straun	301	Expert		57 45
Sept. 12	D. W. Britton	302	Expert		50 00
Sept. 12	Hannah Easley	303	Chambermaids (4)		40 00
Sept. 12	J. Manning	304	Labor		7 50
Sept. 12	S. W. Warner	305	Expert		29 60
Sept. 12	D. P. McCracken	306	Expert		53 14
Sept. 12	W. R. Bowen	307	Pay roll, gates		258 00
Sept. 12	John McDermoid	308	Expert		15 00
Sept. 12	W. C. Coup	309	Attractions		750 00
Sept. 12	L. A. Kent	310	Pay roll, Treasurer		877 50
Sept. 12	W. D. Wildman	311	Superintendent Fair		40 50
Sept. 12	Ben DeGarman	312	Assistant Superintendent Class A		52 00
Sept. 12	F. D. Morrison	313	Hay for Fair		119 55
Sept. 12	Ed. Scroggin	314	Moose		250 00
Sept. 12	F. A. Whittemore	315	Supt. Amphitheatre		25 00
Sept. 12	W. Ruliffson	316	Hay		27 00
Sept. 12	R. H. Stewart	317	Ice weigher		9 00
Sept. 13	Herpolsheimer & Co.	318	Supplies for halls		27 66
Sept. 13	E. L. Vance	319	Class Supt		25 00
Sept. 13	W. J. Hanna	320	Judge		5 00
Sept. 13	A. D. Davis	321	Judge		5 00
Sept. 13	C. E. Worthington	322	Plumbing		22 50
Sept. 13	G. M. Thiele	323	Judge		5 00
Sept. 13	J. R. Megahan	324	Expenses, Poultry Dept		172 25
Sept. 13	S. L. Roberts	325	Poultry expert		50 00
Sept. 13	Orange Judd Farmer	326	Advertising		14 00
Sept. 13	W. D. Hoard	327	Advertising		8 40
Sept. 13	Wm. Dunlap	328	Class Supt		40 00
Sept. 13	C. E. Wiester	329	Ex., tel., and fgt		17 00
Sept. 13	Milton George	330	Advertising		11 20
Sept. 13	Thos. Mulvahill	331	Bill posting		50 00
Sept. 13	E. N. Grennell	332	Service at fair and posting bills		55 00
Sept. 13	Breeders' Gazette	333	Advertising		16 80
Sept. 13	Apthorp Bros	334	Printing		4 50
Sept. 13	L. D. Woodruff	335	Printing		24 65
Sept. 13	Morris Printing Co.	336	Printing		4 50
Sept. 13	Murray & Co.	337	Flags		88 35
Sept. 13	W. A. Judkins	338	Postage		24 95
Sept. 13	C. E. Wiester	339	Ex., tel., and fgt		23 92
Sept. 13	D. W. Shaffer	340	Cartage		4 00
Sept. 13	W. H. H. Clark	341	Labor		1 50
Sept. 13	J. H. Butler	342	Forage		94 64
Sept. 13	News Co	343	Printing		32 80
Sept. 13	J. H. Butler	344	Supt. Forage		60 00
Sept. 13	F. A. Tripp & Co.	345	Refrigerator		121 80
Sept. 13	News Co	346	Advertising		40 00
Sept. 13	Call Publishing Co.	347	Advertising		40 00
Sept. 13	Richard Wright	348	Engineer		20 00
Sept. 13	John Doolittle	349	Class Supt		40 00
Sept. 13	W. R. Bowen	350	Supt. of Gates		50 00
Sept. 13	R. L. Childs	351	Ass't Supt. Art Hall		12 00
Sept. 13	R. W. Furnas	352	Paid ex., fgt. and tel., at Lincoln		16 35
Sept. 13	Special Police	353	Service		40 00
Sept. 13	R. E. French	354	Ass't President		25 00
Sept. 13	J. Jensen	355	Expenses		8 75
Sept. 13	Lincoln Transfer Co.	356	Cartage		4 25
Sept. 13	A. K. Marsh	357	Police pay roll		850 50
Sept. 13	A. K. Marsh	358	Police Supt		12 50
Sept. 13	W. A. Hamilton	359	Painting		33 00
Sept. 13	Glass Co.	360	Glass		40 29
Sept. 13	A. K. Marsh	361	Horse hire		27 00

LIST OF WARRANTS, 1890—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Sept. 13	C. C. Pace	362	Sundries		$27 75
Sept. 13	L. A. Kent	363	Salary, '90		250 00
Sept. 13	R. R. Greer	364	Salary, '90		200 00
Sept. 13	G. W. Maiden	365	Advertising		10 50
Sept. 13	Eli A. Barnes	366	Exp. to Des Moines		13 00
Sept. 13	Rebecca Watkins	367	Expert		25 00
Sept. 13	R. R. Greer	368	Expenses		51 00
Sept. 13	Eli A. Barnes	369	Expenses		23 95
Sept. 13	O. M. Druse	370	Master of Transportation		100 00
Sept. 13	A. Humphrey	371	General Supt		100 00
Sept. 13	J. B. Dinsmore	372	Expenses		11 10
Sept. 13	M. Dunham	373	Expenses		11 50
Sept. 13	C. C. Hungate	374	Clerk, Bd. Managers		30 00
Sept. 13	R. H. Henry	375	Expenses		26 10
Sept. 13	F. H. Young	376	Class Supt		25 00
Sept. 13	Ed. Whitcomb	377	Class Supt		40 00
Sept. 13	B. H. Dunn	378	Ass't Class Supt		48 50
Sept. 13	L. A. Kent	379	Advertising expenses		32 35
Sept. 13	J. B. Dinsmore	380	Class superintendent		40 00
Sept. 13	R. H. Henry	381	Chairman Board Managers		250 00
Sept. 13	M. Dunham	382	Salary Board Managers		187 50
Sept. 13	Eli A. Barnes	383	Salary Board Managers		187 50
Sept. 13	J. Jensen	384	Salary Board Managers		187 50
Sept. 13	J. B. Dinsmore	385	Salary Board Managers		187 50
Sept. 13	M. Basil	386	Labor		22 50
Sept. 13	Capital City Plan'g Co	387	Sawdust		10 50
Sept. 13	L. A. Kent	388	Tilden protest No. 2		52 50
Sept. 13	Windsor Hotel	389	Hotel bill		274 10
Sept. 16	R. W. Furnas	390	Third quarter's salary		500 00
Sept. 16	M. Doolittle	391	To pay fares for parties with Holt county exhibit		23 52
Sept. 16	B. A. Deyarman	392	R. R. fare Holt county exhibit		5 58
Sept. 16	J. H. Schultz	393	R. R. fare Ogallala		15 49
Sept. 16	M. T. Sharp	394	R. R. fare refunded		6 68
Sept. 16	S. M. Brugh	395	R. R. fare refunded		19 08
Sept. 16	W. R. Artman	396	R. R. fare refunded		11 68
Sept. 16	W. W. Watson	397	R. R. fare refunded		6 96
Sept. 19	A. M. Blair	398	Premiums	$17 40	
Sept. 19	Witherold Bros	399	Premiums	2 00	
Sept. 19	C. A. Pearson	400	Premiums	1 00	
Sept. 16	J. H. Steiner	401	Speed fines assessed and collected		35 00
Sept. 18	M. J. Crooks	402	Premiums	1 00	
Sept. 18	W. W. Watson	403	Premiums Jefferson Co. exhibitors	20 30	
Sept. 18	E. B. Atkinson	404	Premiums Burt county exhibitors	16 40	
Sept. 18	W. A. McHenry	405	Premiums	100 00	
Sept. 18	D. F. Risk	406	Premiums	110 40	
Sept. 18	Percheron & Arabian Horse Co	407	Premiums	8 00	
Sept. 18	Berg & Story	408	Premiums	20 00	
Sept. 18	Frank Iams	409	Premiums	40 00	
Sept. 18	John Porbaugh	410	Premiums	18 00	
Sept. 18	John Porbaugh	411	Premiums—stall	6 00	
Sept. 18	E. F. Black	412	Premiums	8 00	
Sept. 18	F. W. Upton	413	Premiums	26 40	
Sept. 18	F. W. Upton	414	Premiums—stall	4 00	
Sept. 18	Ellen Long	415	Premiums	8 00	
Sept. 18	S. D. Gillespie	416	Premiums	4 50	
Sept. 18	W. R. Dawes	417	Premiums	2 00	
Sept. 18	Peter Billing	418	Premiums	16 00	
Sept. 18	F. A. Laurence	419	Premiums	16 00	
Sept. 18	E. B. Collins	420	Premiums	6 40	
Sept. 18	O. O. Hefner	421	Premiums	36 00	
Sept. 18	Judd Bros	422	Premiums	79 20	
Sept. 18	Anna B. Mann	423	Premiums	2 00	
Sept. 18	A. C. Tyrell	424	Premiums	2 00	
Sept. 18	A. H. McClellan	425	Premiums	16 00	
Sept. 18	W. C. Fleury	426	Promiums	8 00	
Sept. 18	W. J. Evans	427	Premiums	4 00	
Sept. 18	M. M. Murray	428	Premiums	54 40	
Sept. 18	J. F. DeFrance	429	Premiums	26 20	
Sept. 18	A. Greenamayer	430	Premiums	5 00	
Sept. 18	Chas. Beerup	431	Premiums	14 40	
Sept. 18	J. G. Duling	432	Premiums	12 00	

LIST OF WARRANTS, 1890—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Sept. 18	R. W. Sherman	433	Premiums	$8 00	
Sept. 18	Richardson, Hughes & Co	434	Premiums	16 00	
Sept. 18	J. E. Smith	435	Premiums	8 00	
Sept. 18	C. E. Holland	436	Premiums	24 00	
Sept. 18	A. C. Sabin	437	Premiums	8 00	
Sept. 18	C. W. Cockrell	438	Premiums	16 00	
Sept. 18	E. Hughes	439	Premiums	8 00	
Sept. 18	I. M. Raymond	440	Premiums—stall	4 00	
Sept. 18	A. Cary	441	Premiums	16 00	
Sept. 18	E. C. Hill	442	Premiums	12 00	
Sept. 18	R. Daniels	443	Premiums	80 00	
Sept. 18	E. E. Day	444	Premiums	40 00	
Sept. 18	Havens Stock Farm	445	Premiums	8 00	
Sept. 18	Ramey & Grimes	446	Premiums	40 00	
Sept. 18	Wm. M. Clark	447	Premiums	20 00	
Sept. 18	Geo. B. French	448	Premiums	16 00	
Sept. 18	Howard Bros.	449	Premiums	4 00	
Sept. 19	A. Skillman	450	Speed	45 00	
Sept. 19	Matie Crooks	451	Premiums	16 80	
Sept. 19	Grace L. Gillespie	452	Premiums	4 00	
Sept. 19	J. R. Lownes	453	Premiums	16 00	
Sept. 19	C. E. Loomis	454	Premiums	4 00	
Sept. 19	Geo. Richardson	455	Premiums	40 00	
Sept. 19	Wm. Miller & Son	456	Premiums	8 00	
Sept. 19	Frank L. Hathaway	457	Premiums	24 00	
Sept. 19	C. H. Ballinger	458	Premiums	98 40	
Sept. 19	A. J. Richardson	459	Premiums	32 80	
Sept. 19	L. B. Wilson	460	Premiums	30 40	
Sept. 19	W. H. & A. P. Seymour	461	Premiums	6 40	
Sept. 19	J. F. Bishop & Son	462	Premiums	12 00	
Sept. 19	J. F. Marshall	463	Premiums	8 00	
Sept. 19	P. J. Gossard	464	Premiums	6 40	
Sept. 19	J. V. Wolfe	465	Premiums	4 00	
Sept. 19	S. L. Wright	466	Premiums	8 00	
Sept. 19	C. H. Searle	467	Premiums	50 40	
Sept. 19	C. H. Chandler	468	Premiums	24 00	
Sept. 19	F. K. Chandler	469	Premiums	32 00	
Sept. 19	L. E. Mahan	470	Premiums	60 00	
Sept. 19	W. E. Spicer	471	Premiums	16 00	
Sept. 19	Mrs. I. Oppenheimer	472	Premiums	4 00	
Sept. 19	C. H. Geist	473	Premiums	8 00	
Sept. 19	N. H. Gentry	474	Premiums	46 40	
Sept. 19	S. T. James	475	Premiums	8 00	
Sept. 19	Vanderslice Bros	476	Premiums	24 00	
Sept. 19	L. H. Suter	477	Premiums	26 40	
Sept. 19	W. L. Dawson	478	Poultry clerk		$7 50
Sept. 19	John Baumer	479	Premiums, Douglas county	46 80	
Sept. 19	Emerson Seed Co.	480	Premiums	24 00	
Sept. 19	Mrs. M W. Witter	481	Premiums	21 20	
Sept. 19	Meek & Kent	482	Premiums	2 00	
Sept. 19	Seeley & Jackson	483	Premiums	1 00	
Sept. 19	J. Burgess	484	Premiums	1 00	
Sept. 19	P. C. Boaren	485	Premiums	4 40	
Sept. 19	Wm. Peppercorn	486	Premiums	3 00	
Sept. 19	A. Lotter	487	Premiums	1 00	
Sept. 19	J. H. Hazzard	488	Premiums	2 00	
Sept. 19	L. J. Randall	489	Premiums	1 00	
Sept. 19	Yarbough—A	490	Premiums	2 00	
Sept. 19	O. W. Hahn	491	Premiums	2 00	
Sept. 19	Eli Smith	492	Premiums	3 00	
Sept. 19	C. Spellman	493	Premiums	1 00	
Sept. 19	B. F. Wilson	494	Premiums	1 00	
Sept. 19	Wm. Rossell	495	Premiums	1 00	
Sept. 19	John Zeiss	496	Premiums	6 00	
Sept. 19	J. G. Herrington	497	Premiums	1 00	
Sept. 19	E. E. Smith	498	Premiums	9 00	
Sept. 19	Geo. Emerson	499	Premiums	2 00	
Sept. 19	F. E. Schwartz	500	Premiums	1 00	
Sept. 19	C. H. Clevinger	501	Premiums	32 80	
Sept. 19	O. S. Woolcott	502	Premiums	19 00	
Sept. 19	H. A. Stoll	503	Premiums	32 00	
Sept. 19	H. C. Stoll	504	Premiums	54 40	

LIST OF WARRANTS, 1890—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Sept. 19	A. G. Porter	505	Premiums	$8 00	
Sept. 25	M. Scott	506	Switching cars		$51 00
Sept. 25	John Steer	507	Premiums	8 00	
Sept. 25	Fred Schroder	508	Premiums	2 40	
Sept. 25	V. H. Dyer	509	Premiums	4 00	
Sept. 25	E. H. Cushman	510	Premiums	2 40	
Sept. 25	C. A. Gesselman	511	Premiums	4 00	
Sept. 25	John Ballard	512	Premiums	2 00	
Sept. 25	C. B. Eckhart	513	Premiums	1 00	
Sept. 25	H. Reader	514	Premiums	2 00	
Sept. 25	H. H. Husted	515	Premiums	1 00	
Sept. 25	Geo. Neligh	516	Premiums	4 00	
Sept. 25	H. Netwick	517	Premiums	2 00	
Sept. 25	R. Van Meker	518	Premiums	2 00	
Sept. 25	Perkins Co. Agr. So.	519	Premiums	2 40	
Sept. 25	John Fritz	520	Premiums	1 50	
Sept. 25	Smith Bros.	521	Premiums	2 40	
Sept. 25	G. Mayfield	522	Premiums	1 50	
Sept. 25	J. M. Quick	523	Premiums	2 40	
Sept. 25	O. C. Gruver	524	Premiums	2 40	
Sept. 25	H. Schumaker	525	Premiums	1 50	
Sept. 25	L. R. Brown	526	Premiums	2 40	
Sept. 25	J. R. Hawkins	527	Premiums	3 00	
Sept. 25	Lee Smith	528	Premiums	16 00	
Sept. 25	M. H. Smith	529	Premiums	12 00	
Sept. 25	Oman Whitney	530	Premiums	4 00	
Sept. 25	S. R. Hall	531	Premiums	4 00	
Sept. 25	F. Hudson	532	Premiums	2 00	
Sept. 25	J. W. Dillon	533	Premiums	2 40	
Sept. 25	Grant Stewart	534	Premiums	1 50	
Sept. 25	Wm. Hellingcamp	535	Premiums	1 50	
Sept. 25	J. C. Robertson	536	Premiums	2 40	
Sept. 25	Major Bros.	537	Premiums	4 00	
Sept. 25	Merchants' Trans. Co.	538	Sawdust and cartage		2 50
Sept. 25	World-Herald	539	Advertising		75 00
Sept. 25	Nebraska Farmer	540	Advertising		30 00
		541	Canceled.		
Sept. 25	H. H. Bagg	542	Premiums	8 00	
Sept. 25	A. J. Benedict	543	Premiums	2 40	
Sept. 25	Cath. DePeel	544	Premiums	20 00	
Sept. 25	Lulu A. Beach	545	Premiums	2 00	
Sept. 25	Mrs. C. M. Leighton	546	Premiums	4 00	
Sept. 25	Mrs. E. J. Fleming	547	Premiums	6 00	
Sept. 27	M. G. Jones	548	Premiums	12 90	
Sept. 27	John Sigerson	549	Premiums	1 00	
Sept. 27	Mary D. Lyman	550	Premiums	3 20	
Sept. 27	Ann Parks	551	Premiums	5 00	
Sept. 27	Miss M. E. Thompson	552	Premiums	3 00	
Sept. 27	Mrs. Porter Hedge	553	Premiums	2 00	
Sept. 27	Mrs. Ann Teason	554	Premiums	1 00	
Sept. 27	Mrs. M. J. Torrence	555	Premiums	2 00	
Sept. 27	Mrs. Wm. Trumbull	556	Premiums	12 40	
Sept. 27	Mrs. E. K. Brown	557	Premiums	10 00	
Sept. 27	M. B. Parker	558	Premiums	14 20	
Sept. 27	R. L. Smith	559	Premiums	3 22	
Sept. 27	H. A. Stoll	560	Premiums, balance	4 00	
Sept. 27	Mrs. F. A. Winchester	561	Premiums	21 40	
Sept. 27	Mrs. A. D. Alexander	562	Premiums	2 00	
Sept. 27	Mrs. C. F. Smith	563	Premiums	3 00	
Sept. 29	W. D. Mann	564	Pay roll (cleaning fair grounds)		107 00
		565	Canceled.		
Sept. 29	Wm. Sutton	566	Premiums	29 85	
Sept. 29	John Petty	567	Premiums	12 00	
Sept. 29	Table Rock Creamery	568	Premiums	33 15	
Sept. 29	J. J. King	569	Premiums	26 55	
Sept. 29	Mrs. D. Housel	570	Premiums	4 00	
Sept. 26	F. I. Rogers	571	Premiums	2 40	
Sept. 29	Mrs. M. E. King	572	Premiums	4 33	
Sept. 29	Mrs. J. S. Temple	573	Premiums	11 40	
Sept. 29	Mrs. D. E. Bixby	574	Premiums	18 46	
Sept. 29	A. F. Hartwell	575	Premiums	8 00	
Sept. 29	Lincoln Cheese Co.	576	Premiums	8 00	
Sept. 29	Nell C. Westcott	577	Premiums	4 00	
Sept. 29	T. M. Sexton	578	Premiums	10 85	

LIST OF WARRANTS, 1890—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Sept. 29	T. M. Sexton	579	Premiums (fgt.)	$1 15	
Sept. 29	Wm. H. Broilliar	580	Premiums	15 35	
Sept. 29	A. Davidson	581	Premiums	15 20	
Sept. 29	J. H. Young	582	Premiums	4 00	
Sept. 29	S. Wooley	583	Premiums	2 40	
Sept. 29	Mrs. J. N. Heater	584	Premiums	49 00	
Sept. 29	Mrs. Ed. Whitcomb	585	Premiums	2 40	
Sept. 29	M. Tower	586	Premiums	12 80	
Sept. 29	J. P. Antrell	587	Premiums	4 00	
Sept. 29	Lasch Bros	588	Premiums	2 00	
Sept. 29	E. L. Jones	589	Premiums	6 00	
Sept. 29	H. C. Dawson	590	Premiums	2 00	
Sept. 29	Alice Peterson	591	Premiums	4 00	
Sept. 29	H. Crowell	592	Premiums	2 00	
Sept. 29	E. G. Trieber	593	Premiums	4 00	
Sept. 29	Ernie Roberts	594	Premiums	2 00	
Sept. 29	Harry Headley	595	Premiums	4 00	
Sept. 29	Bertie Poston	596	Premiums	4 00	
Sept. 29	C. W. Beaver	597	Premiums	4 00	
Sept. 29	Bess E. Ringer	598	Premiums	2 00	
Sept. 29	Bertha Beckman	599	Premiums	4 00	
Sept. 29	Chas. Yates	600	Premiums	4 00	
Sept. 29	Blanche Lamb	601	Premiums	2 00	
Sept. 29	Laura Ireland	602	Premiums	4 00	
Sept. 29	J. W. Werner & Son	603	Premiums	4 00	
Sept. 29	F. E. Brown	604	Ex. score cards		$1 40
Sept. 30	Nellie Dunwoody	605	Premiums	4 00	
Sept. 30	Cora M. Rogers	606	Premiums	5 00	
Sept. 30	Anna Rogers	607	Preminms	6 00	
Sept. 30	Belle Rogers	608	Premiums	6 00	
Sept. 30	Rhetta Childe	609	Premiums	4 00	
Sept. 30	J. Grant Speak	610	Premiums	8 00	
Sept. 30	Eva A. Knapp	611	Premiums	4 00	
Sept. 30	H. I. Kittrell	612	Premiums	4 40	
Sept. 30	L. P. Harris	613	Premiums	14 00	
Sept. 30	Mrs. M. E. Fouts	614	Premiums	4 00	
Sept. 30	Mrs. J. Humpe	615	Premiums	2 00	
		616	Canceled.		
Sept. 30	Minnie U. Burt	617	Premiums	1 00	
Sept. 30	Mrs. C. M. Parker	618	Premiums	2 00	
Sept. 30	Mrs. C. W. Stonesiffer	619	Premiums	5 20	
Sept. 30	Mrs. M. A. Dixon	620	Premiums	8 20	
Sept. 30	Mrs. C. W. Sholes	621	Premiums	4 00	
Sept. 30	Mrs. C. F. Baldwin	622	Premiums	5 80	
Sept. 30	Mrs. A. Beecher	623	Premiums	3 00	
Sept. 30	Mrs. H. C. Wood	624	Premiums	1 00	
Sept. 30	Anna Milburn	625	Premiums	3 00	
Sept. 30	Mrs. E. C. Bewick	626	Premiums	1 00	
Sept. 30	Ida L. Burks	627	Premiums	1 00	
Sept. 30	Mrs. J. R. Shelton	628	Premiums	11 20	
Sept. 30	Mrs. G. Betts	629	Premiums	2 00	
Sept. 30	Mrs. John Doolittle	630	Premiums	3 00	
Sept. 30	Mrs. H. S. Millard	631	Premiums	2 00	
Sept. 30	Grace Scarff	632	Premiums	3 00	
Sept. 30	Mrs. J. B. Wright	633	Premiums	10 00	
Sept. 30	Rosa Frank	634	Premiums	4 00	
Sept. 30	Mrs. J. H. Snider	635	Premiums	6 00	
Sept. 30	Miss Anna Wolf	636	Premiums	6 40	
Sept. 30	Mrs. A. T. Gruetter	637	Premiums	2 00	
Sept. 30	Alfred Gruetter	638	Premiums	6 00	
Sept. 30	Mrs. Cal. Thompson	639	Premiums	1 00	
Sept. 30	Mrs. E. D. Greene	640	Premiums	3 00	
Sept. 30	Mrs. F. C. Warren	641	Premiums	3 40	
Sept. 30	Mrs. W. F. Mathews	642	Premiums	2 00	
Sept. 30	Mrs. J. R. Brinker	643	Premiums	2 00	
Sept. 30	Ella Beckman	644	Premiums	2 00	
Sept. 30	Lizzie Albersmire	645	Premiums	1 00	
Sept. 30	Mrs. B. F. Hill	646	Premiums	2 00	
Sept. 30	Minnie Kramer	647	Premiums	12 80	
Sept. 30	Mrs. C. W. Gray	648	Premiums	50	
Sept. 30	Mrs. F. E. Lahr	649	Premiums	2 00	
Sept. 30	Mrs. W. Houghton	650	Premiums	4 00	
Sept. 30	Lillian Trester	651	Premiums	6 00	

LIST OF WARRANTS, 1890—CONTINUED.

DATE.		TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Sept.	30	Hannah McGrew	652	Premiums	$2 00	
Sept.	30	Mrs. G. F. Baldwin	653	Premiums	2 00	
Sept.	30	Mrs. J. F. Keller	654	Premiums	2 00	
Sept.	30	Mrs. J. F. Temple	655	Premiums	1 00	
Sept.	30	Clara Camp	656	Premiums	1 00	
Sept.	30	Lucy E. Phillips	657	Premiums	3 00	
Sept.	30	Lily A. Gotthelp	658	Premiums	2 00	
Sept.	30	Mrs. Dr. Latta	659	Premiums	2 00	
Oct.	1	May D. Newton	660	Premiums	1 00	
Oct.	1	Mrs. T. A. Mann	661	Premiums	50	
Oct.	1	Anna Yule	662	Premiums	2 00	
Oct.	1	Anna R. Hall	663	Premiums	4 00	
Oct.	1	Miss M. Chapin	664	Premiums	6 40	
Oct.	1	A. Ella Van Brunt	665	Premiums	4 00	
Oct.	1	James Tyler, Jr	666	Premiums	12 00	
Oct.	1	Lenora F. Wilson	667	Premiums	4 40	
Oct.	1	Mrs. A. R. Talbot	668	Premiums	4 40	
Oct.	1	Mrs. M. B. Davis	669	Premiums	2 40	
Oct.	1	Lydia Bohanan	670	Premiums	2 40	
Oct.	1	Mrs. Ida Bennett	671	Premiums	2 40	
Oct.	1	Mrs. J. E. Brown	672	Premiums	2 00	
Oct.	1	C. U. Crandall	673	Premiums	2 00	
Oct.	1	Mrs. J. A. Hayden	674	Premiums	2 00	
Oct.	1	Mrs. Mary Hanna	675	Premiums	1 00	
Oct.	1	Anna Gray	676	Premiums	2 00	
Oct.	1	Mrs. Sarah Topman	677	Premiums	1 00	
Oct.	1	Mrs. J. R. Odebert	678	Premiums	1 00	
Oct.	1	Mrs. W. E. Fuson	679	Premiums	4 20	
Oct.	1	Mrs. A. R. Knight	680	Premiums	1 00	
Oct.	1	Helen D. Larkins	681	Premiums	2 00	
Oct.	1	Nellie F. Gallup	682	Premiums	9 20	
Oct.	1	Mrs. H. S. Fuller	683	Premiums	4 00	
Oct.	1	Mrs. J. L. McGuire	684	Preminms	3 50	
Oct.	1	Mrs. M. H. Schenke	685	Premiums	5 20	
Oct.	1	Mrs. R. O. Adams	686	Premiums	4 20	
Oct.	1	Mrs. F. M. Curtis	687	Premiums	1 00	
Oct.	1	Alice G. Anthill	688	Premiums	1 00	
Oct.	1	Mrs. Wm. Watt	689	Premiums	1 00	
Oct.	1	Mrs. A. W. Smith	690	Premiums	12 40	
Oct.	1	Mrs. E. R. Sizer	691	Premiums	1 00	
Oct.	1	Bessie Sizer	692	Premiums	2 00	
Oct.	1	Mrs. A. B. Baker	693	Premiums	16 50	
Oct.	1	Georgia B. Bell	694	Premiums	9 20	
Oct.	1	Edna Kirkpatrick	695	Premiums	4 20	
Oct.	1	Mrs. J. E. Stockwell	696	Premiums	2 00	
Oct.	1	Mrs. L. F. M. Easterday	697	Premiums	1 00	
Oct.	1	Mrs. Lina F. Sawyer	698	Premiums	2 00	
Oct.	1	Mrs. Sarah A. Hoyt	699	Premiums	1 00	
Oct.	1	Mrs. Flora Kelly	700	Premiums	2 00	
Oct.	1	Mrs. E. H. Andrus	701	Premiums	1 50	
Oct.	1	Clara B. Pancoat	702	Premiums	2 00	
Oct.	1	Theresa Spehn	703	Premiums	2 00	
Oct.	1	Mrs. E. B. Cooper	704	Premiums	4 00	
Oct.	1	Mrs. A. B. Bumstead	705	Premiums	4 00	
Oct.	1	Mrs. Bion Cole	706	Premiums	18 50	
Oct.	1	Maggie Johnson	707	Premiums	4 00	
Oct.	1	Maggie Morrison	708	Premiums	8 00	
Oct.	1	Mrs. M. R. Davey	709	Premiums	2 00	
Oct.	1	Mrs. Ella Logan	710	Premiums	50	
Oct.	1	Clara Carmody	711	Premiums	2 00	
Oct.	1	Mrs. A. W. Dimmie	712	Premiums	4 00	
Oct.	1	Mrs. F. E. Moore	713	Premiums	4 00	
Oct.	1	Ella Wills	714	Premiums	17 60	
Oct.	1	Mrs. E. P. McCraney	715	Premiums	9 50	
Oct.	1	Mrs. C. F. Barras	716	Premiums	2 00	
Oct.	1	Mrs. Lucy Ross	717	Premiums	2 00	
Oct.	1	Mrs. P. A. Cody	718	Premiums	2 00	
Oct.	1	Mrs. E. Sisler	719	Premiums	1 00	
Oct.	1	Mrs. L. W. Kellogg	720	Premiums	1 00	
Oct.	1	Mrs. E. H. Cushman	721	Premiums	2 00	
Oct.	1	Mrs. J. M. Harpham	722	Premiums	2 00	
Oct.	1	Fanny Wells	723	Premiums	1 00	
Oct.	1	Mrs. Ed. Marriner	724	Premiums	2 00	

LIST OF WARRANTS, 1890—CONTINUED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Oct. 1	Mrs. A. F. Anderson	725	Premiums	$2 50	
Oct. 1	Mrs. Frank Chambers	726	Premiums	7 50	
Oct. 1	Jennie A. Slade	727	Premiums	3 00	
Oct. 1	Fred Yule	728	Premiums	2 40	
Oct. 1	A. L. Knapp	729	Premiums	6 80	
Oct. 1	Wm. Roberts	730	Premiums	8 80	
Oct. 1	J. E. Bixby	731	Premiums	4 40	
Oct. 1	P. J. Osterman	732	Premiums	18 40	
Oct. 1	C. F. Swife	733	Premiums	4 80	
Oct. 1	G. H. Batdorf	734	Premiums	30 40	
Oct. 1	L. C. Wren	735	Premiums	24 00	
Oct. 1	J. L. Lyman	736	Premiums	10 40	
Oct. 1	H. C. Reynolds	737	Premiums	3 90	
Oct. 1	A. Lemon	738	Premiums	29 60	
Oct. 1	J. A. Alley	739	Premiums	23 20	
Oct. 1	W. A. Armstrong	740	Premiums	14 40	
Oct. 1	F. L. Wright	741	Premiums	6 40	
Oct. 1	A. M. Trimble	742	Premiums	6 40	
		743	Canceled.		
Oct. 1	D. C. Clapp	744	Premiums	27 00	
Oct. 1	Antone Lettellier	745	Premiums	4 40	
Oct. 1	Carl J. Weick	746	Premiums	13 60	
Oct. 1	James A. McNabb	747	Premiums	9 80	
Oct. 1	C. W. Osterhaut	748	Premiums	13 60	
Oct. 1	George Tye	749	Premiums	2 40	
Oct. 1	L. W. Bryden	750	Premiums	2 00	
Oct. 1	W. A. Judkins	751	Postage, Sept., 1890		$3 87
Oct. 4	World-Herald	752	Advertising fair 1889		5 00
Oct. 4	Percheron & Arabian Horse Co	753	Premium, balance	8 00	
Oct. 10	J. P. Booge	754	Hauling		20 50
		755	Canceled.		
Oct. 10	H. R. Nissley & Co	756	Supplies		1 30
Oct. 10	H. D. Pierson	757	Posting bills		1 00
Oct. 10	Rudge & Morris	758	Supplies		52 68
Oct. 10	J. D. Macfarland	759	Hay		24 60
Oct. 10	S. Carvis	760	Cartage		7 00
Oct. 10	R. L. Childe	761	Clerk textile fabrics		2 00
Oct. 10	Hooker & Orr	762	Plumbing		19 66
Oct. 10	J. E. Utt	763	Straw and hay		280 40
Oct. 11	E. G. Clements	764	Police photos		15 85
Oct. 11	H. Netwick	765	Premiums	2 00	
Oct. 11	M. Doolittle	766	Class superintendent		60 00
Oct. 17	Robt. W. Furnas	767	Fourth quarter's salary		500 00
Oct. 17	Robt. W. Furnas	768	Clerk hire, July 1 to Dec. 31, 1890		300 00
Oct. 17	C. E. Wiester	769	Tel., ex., and fgt., Oct. 1 to 15, 1890		21 10
Oct. 17	C. E. Wiester	770	Ex., tel., and fgt., Sept. 16 to 30, 1890		12 58
Oct. 17	Georgia Hull	771	Clerk class H		5 00
Oct. 17	Celia H. Furnas	772	Copying records Board of Managers fair days		5 00
Oct. 17	Kendall & Smith	773	Forage, balance		5 44
Oct. 17	Robt. W. Furnas	774	Paid freight, fair		1 95
Oct. 17	W. H. Sullivan	775	Cartage		2 50
Oct. 17	Frank Campbell	776	Railroad fare refunded		6 24
Oct. 18	Mrs. G. K. Brown	777	Premiums	1 00	
Oct. 18	S. S. Borton	778	Premiums, balance	84 70	
Oct. 18	George Correvan	779	Premiums, balance	32 75	
Oct. 18	G. G. Lippencott	780	Premiums	2 50	
Oct. 18	S. J. & H. Carpenter	781	Premiums	41 60	
Oct. 18	J. H. Gardner	782	Premiums	14 20	
Oct. 18	Hugh S. Thomas	783	Premiums	16 50	
Oct. 18	Thomas Dobson	784	Premiums	19 00	
Oct. 18	D. Q. Diven	785	Premiums	14 05	
Oct. 18	H. H. Carroll	786	Premiums	7 75	
Oct. 18	J. H. Swisher	787	Premiums	6 80	
Oct. 18	A. C. Davison	788	Premiums	13 00	
Oct. 18	E. M. Shellenbarger	789	Premiums	2 00	
Oct. 18	Smith Bros	790	Premiums	8 80	
Oct. 18	State Hort. So	791	Annual appropriation	1000 00	
Oct. 18	C. F. Stone	792	Premiums	8 00	
Oct. 18	J. R. Lownes	793	Premiums	4 00	
Oct. 18	Geo. B. French	794	Premiums	8 00	
Oct. 20	L. Bruner	795	State Board appropriation		34 94

LIST OF WARRANTS, 1890—CONCLUDED.

DATE.	TO WHOM ISSUED.	NO.	FOR WHAT ISSUED.	PREM.	MISC.
Oct. 20	Gran. Ensign	796	Livery		$38 00
Oct. 20	Nebraska Farmer	797	25 papers		1 25
Oct. 24	J. C. Warner	798	Superintendent bands 1890		25 00
Oct. 25	Herpolsheimer & Co.	799	Supplies poultry department		14 41
Oct. 25	Brownville News	800	Printing circulars		3 80
Oct. 27	B. B. Hoadley	801	Speed, compromise		5 00
Oct. 27	B. B. Hoadley	802	Speed, compromise		15 00
Oct. 27	Dunton & Horseman	803	Speed, advertising		134 66
Oct. 27	Union Corn House	804	Forage		4 50
Oct. 28	Wirrick & Hopper	805	Book case		10 00
Oct. 29	W. H. Warner & Bro.	806	Medals		40 00
Nov. 5	W. A. Judkins	807	Postage, Oct., 1889		12 69
Nov. 5	C. E. Wiester	808	Fgt., tel., and ex., Oct. 16 to 30		14 86
Nov. 7	A. Lemon	809	Premiums	$8 00	
Nov. 10	H. J. Hill	810	Protest and annual dues		30 00
Nov. 27	L. W. Parrotte	811	Speed	150 00	
Nov. 27	Morris J. Jones	812	Speed	250 00	
Dec. 4	J. Russell Lownes	813	Premiums	100 00	
Dec. 4	B. O. Cowan	814	Premiums	50 00	
Dec. 12	Brownville News	815	Printing		4 00
Dec. 12	E. McIntyre	816	Expenses, Chicago		26 00
Dec. 12	C. E. Wiester	817	Ex., tel., and fgt., Nov. 1 to 14		12 50
Dec. 12	J. M. Wolfe & Co.	818	State Directory		6 00
Dec. 12	District Fair Ass'n	819	Dues 1890		5 00
Dec. 12	W. A. Judkins	820	Postage, Nov., 1890		6 47
Dec. 12	J. Q. A. Smith	821	Ex., fgt., and tel., Nov. 14 to 30		5 31
Dec. 12	State Journal Co.	822	Supplies Secretary's office		155 32
Dec. 12	Lillibridge & Roose	823	Writing diplomas		23 40
Dec. 12	J. Jensen	824	Expenses, Chicago		24 75
Dec. 12	R. H. Henry	825	Expenses, Chicago		8 75
Dec. 12	J. B. Dinsmore	826	Expenses, Chicago		29 50
Dec. 12	D. T. Mount	827	Delegate American Trotting Ass'n		12 75
Dec. 12	G. F. Dickman	828	Services Review Board		5 00
Dec. 12	Bohanan Bros	829	Livery		9 50
Dec. 12	Windsor Hotel	830	Hotel bills		77 65
Dec. 19	Lincoln News Co.	831	Advertising		2 70
Dec. 19	Frank Kaplin	832	Premiums	2 00	
Dec. 29	Peter L. Krider & Co.	833	Medals		230 02
Dec. 31	J. Q. A. Smith	834	Ex., tel., and fgt., Dec. 31		7 21
Dec. 31	W. A. Judkins	835	Postage, Dec., 1890		86 40
			Total premiums	$13669 73	
			Total expenses		$21744 75
			Total amount of warrants		35414 48

The Secretary presented the following statement of his account with the Treasurer for the year past:

As required by law, I herewith present the items with which I have charged the Treasurer for the year 1890:

Balance	$8777 20
Error warrant No. 59	13 25
Sale of corn	1 03
Horticultural corn exhibit	8 75
General admission tickets	12445 50
Amphitheatre tickets	2736 25
Quarter stretch tickets	928 50
Booth privileges	3850 00
Hack stands	494 00
Camping permits	169 50
Supply wagons	50 00

Forage account	$468 65
State apportionment	2000 00
Speed money	4269 80
Stall money	911 50
Speed fines	197 55
Advertising in Premium List	271 25
Advertising on water wagon	20 00
B. & M. R. R. coupons	6931 50
U. P. R. R. coupons	1595 00
Mo. Pac. R. R. coupons	986 50
F., E. & M. V. R. R. coupons	1211 00
St. Paul coupons	23 00
Columbus Buggy Co.	112 50
Freight repaid	1 15
A. S. B. Association premiums	150 00
1889 warrants returned by Secretary	7 00
Score cards	75 00
Programmes	50 00
	$48755 38

ROBT. W. FURNAS, *Secretary.*

The Secretary presented the following statement as to funds passing through his hands the year past:

ROBT. W. FURNAS, SECRETARY, IN ACCOUNT WITH
NEBRASKA STATE BOARD OF AGRICULTURE, 1890.

To cash received: DR.

Speed entries	$4252 30
Stall rents	894 50
Score card privilege	75 00
Programme privilege	50 00
Advertising, Premium List	263 75
From State Horticultural Society	8 75
Sale of corn	1 03
Speed penalty collected	52 00
Error in warrant No. 59, 1889	13 25
State appropriation, 1890	2000 00
Freight refunded	1 15
Speed penalty collected	83 05
Advertising in Premium List	7 50
Speed money	17 50
Water wagon, advertising	20 00
Stall money	17 00
Old warrants returned	7 00
Speed fine	10 00
From American Short-Horn Breeders' Association	150 00
Speed fine collected	52 50
	$7976 33

CR.

By Treasurer's receipts	$7976 33

REPORT OF DELEGATES TO ILLINOIS STATE FAIR.

The delegation to the Illinois State Fair, 1890, reported as follows, which was accepted and ordered to be spread upon the minutes of these proceedings:

"LINCOLN, NEB., January 17, 1891.

"*To the Honorable State Board of Agriculture of Nebraska:* GENTLEMEN—Your delegates to Illinois State Fair, 1890, held at Peoria, Illinois, would respectfully submit the following report:

"That we were most cordially received, and every courtesy extended by the officers of the fair management to make our visit pleasant and profitable. We are unanimous in our opinion that the fair was a very successful one, and reflects great credit upon the management of its several departments. It would be impossible in this report to give a description of the fine displays made, in their classes; we were especially attracted to the arrangement of buildings for the accommodation of horses and cattle. Exhibitors said they were very satisfactory, with some slight alterations in length, width, and height of stalls. Inquiry developed the fact that there was general complaint against our present accommodations, and several prominent exhibitors had taken their stock to Minneapolis and elsewhere on that account only. We would recommend that the State Board take action in the matter, and put up such buildings. It was also demonstrated that the policy of giving liberal premiums to collective exhibits by counties and societies is beneficial, and we believe the present amount could be extended with good results.

S. H. WEBSTER,
"J. B. McDOWELL."

REPORT OF DELEGATE TO DISTRICT FAIR ASSOCIATION AND INTERNATIONAL ASSOCIATION FAIRS AND EXPOSITIONS.

As your delegate to the International Association of Fairs and Expositions and Western District Fair Association I have to report: The first named convened at Detroit, Mich., on the 14th day of November last. I was not able to attend; nor was the alternate, Mr. Macfarland. Hence, Nebraska was not represented.

The Secretary advises me the meeting was of unusual interest, much better attended than for any previous year, showing the organization to be in prosperous condition. There were many important matters connected with fair and exposition work considered and disposed of, and which will in due time appear in the forthcoming printed proceedings. The officers elected for the current year are the same as last year: Robt. W. Furnas, Nebraska, president, and H. J. Hill, Toronto, Canada, secretary and treasurer.

The Western District Fair Association met at Chicago on the 18th of November. There were in attendance delegates from Minnesota, Wisconsin, Illinois, Iowa, Nebraska, Kansas, Wyoming, Oregon, South Dakota, Ohio, Indiana, Colorado, and Missouri, showing increased interest in this organization. Among the important transactions of this body, at this session, was, through a committee of one from each state represented, the presentation of a uniform system of live stock premiums, and which is presented for the consideration, and I trust ratification, of this Board. The officers elected were: Robt. W. Furnas, Nebraska, president, and E. C. Lewis, Illinois, secretary and treasurer.

The fair dates agreed upon were, so far as Nebraska is concerned, the same as last year—commencing the second week in September. This requires the approval of this Board. The full line of fair dates agreed upon for the year 1891 were: Missouri, Sedalia, August, third week; Iowa, Des Moines, last week of August and first week of September; Minnesota, Hamline, September, second; Nebraska, Lincoln, September, second week; Kansas, Topeka, September, third week; Oregon, Salem, September, third week; Ohio, Columbus, September, third week; Wisconsin, Milwaukee, September, third week; Wyoming, Cheyenne, September, third week; Indiana, Indianapolis, September, fourth week; Illinois, Peoria, last week of September and first week of October. All to be followed by the St. Louis Fair and Exposition.

ROBT. W. FURNAS, *Delegate.*

The financial portions of all reports were referred to a committee consisting of:

H. W. Parker...Gage county.
Chas. Hoevet...Clay county.
J. R. Robinson...Dodge county.
J. T. Mallalieu...Buffalo county.
R. H. Templeton...Burt county.

All other portions of all reports were referred to a committee consisting of:

Wm. R. Bowen...Douglas county.
E. McIntyre...Seward county.
J. M. Lee...Furnas county.

The President appointed as a committee to award premiums on winter corn exhibit:

Frank H. Young...Custer county.
J. B. McDowell...Jefferson county.
A. E. Baker...Seward county.

On motion, nominations were made to fill vacancies on the Board occasioned by expiration of term of service and otherwise.

The membership held by W. H. Holmes, of Antelope county, by reason of non-attendance and not furnishing an excuse, was declared vacant.

The following nominations were made, and referred to a committee consisting of J. H. Westcott, Lancaster county; W. L. May, Dodge county; H. Lawson, Otoe county; N. S. Wright, Pawnee county, and S. M. Barker, Merrick county:

H. W. Parker...Gage county.
C. K. Lawson...Adams county.
P. H. Berry...Greeley county.
J. C. Warner...Webster county.
R. A. Templeton...Burt county.
R. W. Furnas...Nemaha county.
E. N. Grennell...Washington county.
LeRoy Judd...Richardson county.
R. H. Henry...Platte county.
John Jensen...Fillmore county.
Frank Emerson...Douglas county.
E. A. Barnes...Hall county.

J. B. Dinsmore ....Clay county.
M. Dunham ....Douglas county.
Henry Fry ....York county.
W. H. Barstow ....Saline county.
A. Humphrey ....Lancaster county.
F. M. Young..Custer county.
J. S. Hayes..Hitchcock county.
R. W. Blake ....Rock county.
Fred Gorder..Cass county.
L. A. Becher ....Antelope county.
J. T. Mallalieu..Buffalo county.
H. Piasecki ....Howard county.
Alex. Legg..Colfax county.
A. T. Holt ....Knox county.

The President was empowered to arrange a detailed programme for the exercises during this meeting.

The Board adjourned to meet at this place again at 7:30 o'clock this evening, to hear Prof. B. E. Fernow, now of the Forestry Division of the United States Department of Agriculture, Washington city, D. C.

EVENING SESSION.

JANUARY 20, 7:30 P. M., 1891.

Board met pursuant to adjournment. Present: officers as before, with a large attendance of visitors.

Prof. B. E. Fernow addressed the meeting on the subject of "Forestry and Tree Planting on Western Prairies." He was listened to with much interest and closed with the hearty applause of the audience. A unanimous vote of thanks was tendered the professor, and a copy of his address solicited for publication in the annual report volume of the Board. The address will be found in full in the Appendix.

Adjourned to meet to-morrow morning at 9 o'clock.

SECOND DAY.

JANUARY 21, 1891.

Board met pursuant to adjournment. Officers as before. Quorum present on roll call.

REPORT OF COMMITTEE ON NEW MEMBERS.

"Your committee to recommend names of members of the State Board for the ensuing two years respectfully report the following:

Robt. W. Furnas ....Nemaha county.
E. N. Grennell ....Washington county.
J. Jensen ....Fillmore county.
E. A. Barnes..Hall county.
J. B. Dinsmore..Clay county.

M. Dunham .... Douglas county.
R. H. Henry .... Platte county.
J. S. Hughes .... Hayes county.
W. H. Barstow .... Saline county.
A. Humphrey .... Lancaster county.
F. H. Young .... Custer county.
J. C. Warner .... Webster county.
LeRoy Judd .... Richardson county.
H. W. Parker .... Gage county.

"P. H. Barry, Greeley county, to fill the vacancy of S. H. Webster.

"L. A. Becher, of Antelope county, to fill the vacancy of W. H. Holmes.

"All of which is respectfully submitted.

"J. H. WESTCOTT, *Chairman.*
"N. S. WRIGHT.
"H. LAWSON.
"S. M. BARKER.
"W. L. MAY."

The report of the committee was unanimously adopted, and the persons named declared duly elected.

ELECTION OF OFFICERS.

The Board, on motion, proceeded to elect officers for the year, which resulted as follows:

J. Jensen, of Fillmore county, was nominated for President. There being no other nomination, the Secretary was instructed to cast a unanimous ballot for Mr. Jensen, which was done, and he was declared elected.

Messrs. Grennell and McDowell were appointed to conduct the President-elect to the chair, which was done, and Mr. Jensen briefly returned thanks for the honor conferred, and pledging his best ability to the duties of the office.

The following officers were then elected, each by a unanimous vote:

Eli A. Barnes, of Hall county .... First Vice President.
E. N. Grennell, of Washington county .... Second Vice President.
Edmund McIntyre, of Seward county .... Treasurer.
Robt. W. Furnas, of Nemaha county .... Secretary.
Austin Humphrey, of Lancaster county .... General Superintendent.

On motion, all other officers and superintendents of classes were left with the Board of Managers, with power to fill.

Prof. Chas. E. Bessey, State Botanist for the Board, then submitted his annual report, and addressed the Board on the subject, "A Dozen Nebraska Grasses and Clovers." His address, in full, will be found in its place in the Appendix of this volume.

Prof. H. H. Nicholson, Director of the United States Experiment Station, then read an interesting paper: "The Lines of Work in Progress or to be Undertaken by this Station." The thanks of the Board were tendered, and a copy of his paper solicited. It will be found in the Appendix.

The committee appointed by the President to revise the Premium List, Rules, Regulations, etc., reported progress and asked further time. Time was granted,

and the committee directed to render its final report to the new Board of Managers, and the said Board of Managers were empowered to consider, accept, or amend the report as it may deem for the best interests of the State Fair.

In this connection the matter of offering liberal premiums for the cultivation of sugar beets in Nebraska was presented. Mr. McIntyre offered the following resolution:

Resolved, That in view of the importance of the development of the sugar beet industry, and demonstrating to the satisfaction of all concerned whether or not the general public interested in agricultural pursuits in this state can and will find it feasible to profusely cultivate sugar beets for sugar making purposes, etc.: Therefore,

Resolved, That $500, or so much thereof as may be necessary, be set apart to be expended as in the discretion of the Board of Managers may consider the most practical.

Mr. Emerson offered as a substitute the following:

"The State Board of Agriculture, to encourage the great beet sugar industry throughout the state of Nebraska, offer premiums for the first, second, third, fourth, and fifth best one acre of sugar beets produced in the state during the season of 1891.

"Said premiums to be, viz: First, $400; second, $300; third, $150; fourth, $100; fifth, $50; and the State Board of Agriculture be and hereby is authorized to appropriate the sum of $1,000 for the purpose named.

"The conditions upon which the award is made to be, viz:

"First—The acre entered for premium to be one contiguous acre, to be certified to by two disinterested witnesses.

"Second—Accompanying the entry, which shall not be made later than October 15, 1891, and which shall be filed in writing with the Secretary of the State Board of Agriculture, there shall be a full and complete itemized statement covering the following details, viz:

"Description of the character of the soil on which the beets were grown, stating whether on new or old land, and if old, what crop was grown on same the previous season, and if fertilizer had been used on same, what kind and quantity.

"When ground was plowed and depth of plowing.

"Mode of preparing soil prior to planting.

"How planted and distance between the rows.

"Name of variety of beet and number of pounds of seed used.

"When and how each cultivation was performed.

"When the beets were thinned out, and average distance apart in the row.

"When harvested and certified weight of crop without tops, and that the Secretary of the Board is hereby instructed to have blank forms printed to facilitate and simplify the statement of the grower.

"Third—A sample of not less than fifteen beets, representing the average size of the beets produced, to be forwarded to Prof. H. H. Nicholson, University Experiment Station, Lincoln, Nebraska, for analysis, with a duplicate statement of the conditions under which the crop was grown, as above described. Samples referred to to be selected from different parts of the acre, and to be harvested and forwarded to Prof. Nicholson before being exposed to frost.

"Fourth—The premiums to be awarded by a committee composed of three

members, to be appointed by the Board of Managers. Said committee to determine the awards on a basis of the analysis showing the greatest number of pounds of sugar produced per acre; also taking into consideration the extent and minuteness of the detailed statement or report submitted by the competitor.

"Fifth—The committee on awards to report the same to the State Board of Agriculture at its annual meeting in January, 1891."

After quite a discussion, participated in by most of the members present, the whole matter was referred to the Board of Managers to take such action as it may deem advisable and for the best.

REPORT OF COMMITTEE ON ANNUAL REPORTS OF OFFICERS.

Mr. Bowen, chairman of committee to whom was referred those portions of annual reports of officers other than financial, submitted the following report, which was adopted:

"*To the State Board of Agriculture:* Your committee to which was referred the address of President Greer and Secretary Furnas submit the following report thereon:

"Your committee shares with our President his exultation over the high agricultural standing of Nebraska, notwithstanding the loss of crops this year in a few frontier counties because of prolonged drouth, his view being fully sustained by the unusual excellence of our last fair.

"Your committee recommends that to a committee of three be referred so much of the address and report as relates to the Columbian Exposition, with full authority and instruction to secure the desired legislation and appropriation.

"Your committee recommends the adoption of the following resolution:

"*Resolved,* That the thanks of this Board are due and are hereby tendered to our President, Robert R. Greer, for his fair and judicious administration of affairs during his term of office, successfully availing himself of the experience of past years, and hopefully striving to secure excellence for the future.

"Your committee is in full accord with the expression of our Secretary, that a state fair is an educational institution, and further is of opinion that such education should be amplified for those who attend our fairs and also be extended to those who are remote; that is to say, the fact that the Nebraska State Fair is annually 'the greatest show on earth' should be published to the world, through the medium of the press and the Associated Press dispatches. Your committee therefore recommends the adoption of the following:

"*Resolved,* That it is the sense of this meeting that the different breeds of horses, cattle, sheep, swine, and poultry, the different varieties of all cereals and vegetables, etc., etc., exhibited at our fairs should be accurately and distinctly indicated by placards; and that our Board of Managers are hereby requested to provide ways and means therefor, in order that our patrons and visitors may thereby acquire knowledge.

"*Resolved,* That it is the sense of this meeting that it will be a judicious and commendable investment of our funds, from which our state will reap much benefit, to secure publication in the Associated Press dispatches of the United States during the week of our annual fairs, of half a column or so daily, descriptive of our exhibits; and our Board of Managers are hereby requested to carry these views into operation.

"Your committee recommends that hereafter the reports of county agricultural societies be made on November 30 of each year; and your committee further

recommends that the reports from county societies be published in the annual report of 1890.

"Your committee appreciates the value of the new schedule and classification of entries as contemplated; but we call attention to the fact that its adoption will involve a considerable increase in the total of premiums offered in the several classes.

"Your committee recommends the disposition of last winter's corn exhibit proposed by our Secretary be confirmed; and that the thanks of the State Board be conveyed by our Secretary to Col. Murphy for his zeal in displaying the corn products of Nebraska.

"Your committee recommends that the proposed use as a museum of one of our rooms at the state capitol be referred to the Board of Managers for such action as may seem judicious.

"It is recommended that the county societies be urged to place in our rooms at the capitol, exhibits in cases similar to the one there placed by our Secretary, and that the committee on legislation already recommended take into consideration the matter of appropriation by the legislature to cover the cost of these cases; also that the cost of the case already provided by our Secretary be refunded to him.

"We recommend that one hundred dollars be placed at the disposal of our Secretary for framing and hanging our photographic views of exhibits at our recent State Fairs.

"We recommend the adoption of the following:

"*Resolved*, That the thanks of the State Board of Agriculture are hereby tendered to the newspapers of Nebraska, and to the railroads and express companies, for their valuable aid in creating successful State Fairs.

"We report back for consideration by the whole Board, the recommendation that one thousand dollars of our funds be contributed to the state relief Fund.

"Respectfully submitted.

"W. R. Bowen,
"J. M. Lee,
"E. McIntyre,
"*Committee.*"

That portion of the report referring to the Secretary's recommendation to appropriate $1,000 for the benefit of western sufferers was taken up. After a very general discussion, and motions to appropriate various sums, from $1,000 to $2,000, the whole matter was disposed of by the adoption of the following preamble and resolution, offered by Mr. Dinsmore, of Clay county:

Whereas, There has been a proposition presented for the consideration of this Board to donate from the funds of this Board the sum of $1,000 for the relief of the drouth-stricken sufferers of the state; and

Whereas, There is a grave doubt as to the right of the Board to use any of its funds in the way indicated; Therefore, be it

Resolved, That we respectfully but earnestly urge upon the representatives of the people of the state to at once, by enactment, provide an amount sufficient to meet and relieve the prevailing distress for food, fuel, and clothing, and that provision be made at once to supply seed grain to the sufferers of the state as will enable the farmers to sow and plant the crops of the coming season.

The Board adjourned to meet again at this place, at 1:30 this afternoon.

AFTERNOON SESSION.

JANUARY 21, 1:30 P. M., 1891.

Board met pursuant to adjournment. Officers as before.

Prof. Lawrence Bruner, of the United States Experiment Station and Entomologist for the Board, read a paper: "Insect Enemies of the Sugar Beet."

Prof. J. S. Kingsley, of the State University, addressed the Board. Subject: "How Shall We Teach Agriculture?"

Prof. D. B. Brace, of the State University, addressed the Board, accompanied with diagrams and illustrations on the subject of "Meteorology as Connected with Agriculture."

James Pearson, of Greenwood, read a paper: "Profits and Pleasure of Silk Culture."

Thanks of the Board were tendered each of the above, and copies of papers read solicited for publication in the annual volume. They will be found in the Appendix.

Prof. L. E. Hicks, Geologist for the Board, owing to illness, was not able to complete his paper, "Fertilizing by Means of Irrigation," asked to be excused, and he would have the paper ready for publication in the annual volume.

Prof. Rachel Lloyd, of the Experiment Station, owing to press of other work, was not able to present the paper promised on the subject of the "Sugar Beet Industry and Chemical Analyzation."

S. C. Bassett, secretary of the State Dairymen's Association, being confined to his home by illness, was unable to prepare and present a paper touching that industry.

FARMERS' INSTITUTES.

Mr. P. H. Barry, from the committee appointed at the last meeting of this Board, touching the matter of providing farmers' institutes in Nebraska, submitted the following report, which was accepted and approved:

"On the matter of farmers' institutes, which was referred to your committee, we beg leave to submit the following report:

"March 10, 1890, at the call of the Director of the Experiment Station, we held a conference with the Executive Committee at the State University, and agreed to invite all kindred associations to aid us in formulating a successful plan of farmers' institutes, and in view of the fact that the fall of the year would be the most propitious time to arrange for such a meeting, we adjourned to meet in November.

"December 16, 1890, your committee again met in conference with the Board of Regents at the State University, and as the Nebraska State Farmers' Alliance was then in session in this city, an invitation was sent to that body to appoint a committee of three to meet a like committee from the State Board of Agriculture, the State Horticultural Society, and the Board of Regents, the same to convene at the University building to formulate a bill to be presented to the legislature for their approval, asking for a small appropriation to carry the same into effect; and your committee are glad to report that the above conference was successful in formulating such a bill, and that the same received the endorsement of the Nebraska State Farmers' Alliance before its adjournment."

EXPERIMENT STATION AND STATE FARM.

Mr. P. H. Barry, from the committee appointed by this Board at its last meeting to visit the Experiment Station and State Farm, reported as follows, which report was accepted:

"March 8, visited State Farm, and were disapppointed to see it in such poor condition; with fences not in condition to hold cattle; a herd of hogs without a pasture, and barns no doubt that were good enough years ago, but to-day they are not fit to shelter in an economical manner the stock and fodder to feed now on the farm, and your committee were informed by those in authority that the legislature of 1889 were to blame for the poor condition of the farm, in not providing an appropriation for its maintenance, and that the farm had to be kept up and the work of the station carried on out of the fund of the University. Your committee believe that this farm should be a matter of pride to the citizens of this state, and should be kept in such a condition that the agricultural students of our University should be able to point to it with pride as the best model farm in this grand union of states.

"And to put this farm in such a condition as to meet the views of your committee, we would most respectfully make the following recommendations:

"First—That a commodious barn be erected, large enough to shelter all stock and feed for same now on the farm.

"Second—That the pastures be properly fenced.

"Third—That a good pasture, with plenty of shade, be provided for hogs.

"And that all surplus stock now on the farm be sold off. That a practical farmer be placed in charge of the farm, with full control of the same, and that he be held responsible for its management. And that but one breed of thoroughbred cattle, and they the very best, should be kept on the farm for the present. And there should be an annual sale, at which all the surplus stock of the farm should be sold to the highest bidder.

"EXPERIMENT STATION.

"March 9, visited the Station in company with Mr. Jared Smith, and viewed the experiment grounds and cordially approved of Mr. Smith's plan, but am sorry to report that no result was reached, and your committee believe this was mainly due to a misunderstanding between the agriculturist and the foreman of the farm, and to remedy these matters, your committee would make the following recommendations:

"First—That so much of the College Farm be set apart, together with all stock necessary, to carry on the work of the Experiment Station, and the same be placed under the charge of the Director of the Experiment Station.

"Second—That the Director of the Station should not be expected to teach, as we believe that no man can succcessfully study the interests of this great agricultural state and guard the same, and teach at the same time.

"Third—We would most respectfully urge the Board of Regents to select a competent person to take up the investigation of animal diseases where that man, Dr. Billings, who by his work has reflected on this state, laid it down.

"Fourth—And we would most earnestly urge this Board to petition the legislature to erect a laboratory for the investigation of animal diseases on the Experiment Grounds.

"And your committee would further recommend to the Regents of the University, that the short elementary course in dairying now in the course at the Wisconsin Agricultural College be adopted in our own Agricultural College, in addition to its regular course.

"December 18, your committee again visited the Farm and Station, and found the stock looking well, and the winter wheat, rye, and oats looking very promising.

"December 19, had a conference with the Regents of the University; suggested to them plan for the farm, and recommended the adoption of the Wisconsin plan of short winter course of dairying in addition to its regular course. And the same was cordially received by them. And from the experience of your committee during the past year, we would earnestly recommend that an advisory committee of three be appointed from this body, to aid the Regents and Director of the Experiment Station to carry its work to a successful result, and report the result of their labor to this Board."

In connection with this report, Mr. McIntyre offered the following petition and resolution, which was unanimously adopted:

"*To the Senate and House of Representatives of the State of Nebraska:*

"*Resolved*, That we, the members of the Nebraska State Board of Agriculture, in regular annual meeting assembled, would most respectfully but earnestly petition your honorable body to appropriate a sufficient sum from the funds of the State University, now in the state treasury, and not otherwise appropriated, for the erection and equipping of a building in connection with the University of Nebraska, to be located upon the grounds belonging to and constituting the Experimental Farm of the Agricultural and Industrial College of said University, the said building to be designated and known as the Patho-Biological Laboratory of the University of Nebraska. With this end in view we most heartily endorse House Roll No. ——, and would earnestly ask its passage."

The committee to which was referred to the Secretary's and Treasurer's reports submit the following, which was approved and adopted:

"*Mr. President, and Gentlemen of the Nebraska State Board of Agriculture:* Your committee appointed to examine and report on the Secretary's and Treasurer's reports for the year ending January 1, 1891, beg leave to submit the following:

"We have carefully examined and compared the warrants issued by the Secretary, and those that have been presented to and paid by the Treasurer, and find the same to correspond, and are correct as reported by the said Secretary and Treasurer.

"Total amount of warrants drawn by the Secretary, from Nos. 1 to 835, inclusive, $35,414.48.

"The following warrants for 1890 are unpaid:

No. 182	$8 75
No. 200	35 00
No. 320	5 00
No. 323	5 00
No. 341	1 50
No. 427	4 00
No. 494	1 00
No. 519	2 40

No. 535	$1 50
No. 642	2 00
No. 648	50
No. 669	2 40
No. 687	1 00
No. 689	1 00
No. 777	1 00
Total	$72 05

"The Treasurer's report shows as follows:

Balance on hand, January 22, 1890	$8777 20	
Total receipts for year ended	39973 13	
Grand total		$48755 33
Warrants paid for 1890	$35333 08	
Warrants paid for 1889	17 00	
Error in warrant No. 368	1 00	
Total paid		35351 08
Balance on hand January 21, 1891		$13404 25

"H. W. PARKER, *Chairman*.
"CHAS. HOEVET.
"JOHN T. MALLALIEU."

The President nominated the following Board of Managers. The nominations were confirmed by a unanimous vote of the Board:

Chairman, R. H. Henry	Columbus.
J. B. Dinsmore	Sutton.
Martin Dunham	Omaha.
L. A. Kent	Minden.
Milton Doolittle	Atkinson.

The following preambles and resolution adopted by the Custer County Agricultural Society were read, and ordered spread upon the minutes of this meeting:

WHEREAS, The Custer County Agricultural Society has been awarded the gold medal for being the successful competitor three successive years; and

WHEREAS, The officers of this society having said exhibit in charge have been uniformly treated with the greatest kindness and courtesy by the officers of the State Board of Agriculture; be it

Resolved, That this society tender its thanks to said Board for such kindness and courtesy.

J. D. REAM, *President*.

W. H. CRAMER, *Secretary*.

STATE POULTRY ASSOCIATION.

The following communication from the Nebraska State Poultry Association was read, and referred to the new Board of Managers with a request the petition be granted:

"LINCOLN, NEB., January 20, 1891.

"*To the State Board of Agriculture, in session at Lincoln:* GENTLEMEN—The undersigned, officers and members of the Nebraska Poultry Association, respectfully

represent that they are organized for the purpose of encouraging the interest and promoting improvement in the breeding and management of poultry, by means of exhibitions, and collecting and disseminating reliable and practical information concerning the care and culture of improved breeds of poultry; that they have hitherto succeeded in arousing a wide-spread interest in the state in the breeding and care of thoroughbred poultry; that it is largely due to our efforts and influence that the magnificent poultry house at the State Fair grounds was so creditably filled last September; that the association is ambitious of still further extending its influence and usefulness, and to that end is engaged in giving a winter exhibition of thoroughbred poultry in the city of Lincoln the present week, to which many of the best breeders of the state have brought their choicest stock; and that to encourage and assist our association in its work, which is directly auxiliary to the poultry attraction of the State Fair exhibitions, the State Board of Agriculture is respectfully asked to appropriate to the present use and benefit of the State Poultry Association the sum of one hundred dollars, to be paid to the treasurer of our association as aid for the purpose set forth.

"We respectfully call your attention to the fact that we have revised the premium list of the Board, so far as relates to Class 'F,' Poultry, throwing out about fifty-two varieties, for which premiums have heretofore been offered and paid, and by thus dropping these varieties from the premium list, have reduced the prizes liable to be paid by the Board thereupon, by the amount of $250; and that as a measure of economy, at the same time giving aid and encouragement in a direction where it will benefit the substantial and meritorious breeds of poultry, the sum of one hundred dollars thus saved can well be granted to our association.

"Respectfully,

"S. L. ROBERTS, Tekamah,
President.
"J. L. LYMAN, Tekamah,
Vice President.
"JOHN R. MEGAHAN, Lincoln,
Secretary and Treasurer.
"GEO. W. OSTERHAUT, David City.
"ALBERT LEMON, Lincoln.
"J. A. MCNABB, Lincoln.
"LEWIS C. REN, Bellwood.
"GRANT H. BATDORF, Omaha.
"S. S. BORTON, Beatrice."

On motion, the following resolution, offered by Mr. Dinsmore, was adopted:

Resolved, That a committee consisting of the following named gentlemen be created, who shall be charged with the formulating of a resolution expressing the regret of this Board at the severance of the relations heretofore existing between this Board and Mr. S. H. Webster, by his resignation, and expressing our appreciation of his services as a working member of this Board. Committee: P. H. Barry, R. W. Furnas, Wm. R. Bowen.

Mr. Barry, the chairman, asked time to prepare the expression, and furnish the Secretary for publication in annual volume.

In due time Mr. Barry reported as follows:

WHEREAS, S. H. Webster has for years past been an active, valuable, working member of this Board, filling some of the most laborious and difficult positions; and

WHEREAS, His business relations have been such as to require him leaving the state, and therefore tendering his resignation: Therefore, be it

Resolved, That the thanks of this Board are hereby tendered Mr. Webster for his valuable services, and that our best wishes follow, and we cheerfully commend him to those with whom his lot may hereafter be cast.

Resolved, That the Secretary be and is hereby instructed to furnish Mr. Webster with a copy of these preambles and resolutions.

On motion of Mr. Hayward, the following resolution was adopted:

Resolved, That the sum of six thousand five hundred dollars be and is hereby appropriated by this Board, to be offered in purses and stakes for the speed department for the State Fair of the year 1891, under a programme to be arranged by the Board of Managers, and that the sum of fifteen hundred dollars, or so much thereof as may be necessary, be and is hereby appropriated for such special attractions as the Board of Managers may deem wise to secure for the State Fair of the current year.

On motion, the following resolution was adopted:

Resolved, That Prof. Goodwin D. Swezey, director Boswell Observatory, Crete, Nebraska, be and is hereby appointed State Meteorologist for this Board, and that the sum of $100, or so much thereof as may be required, be appropriated annually, until further directed, to defray the expense of his work.

On motion, the sum of $50 was added to the appropriation heretofore provided for defraying the expenses of Prof. Bruner, Entomologist for the Board, making the total annual appropriation $100.

President Jensen appointed J. B. McDowell, R. R. Greer, and Robt. W. Furnas a committee to look after legislative matters, in which this Board is interested, more especially an appropriation for the World's Fair at Chicago.

The question of enlarging the grand stand was discussed, but no definite action taken, leaving the whole matter with the President and Board of Managers.

The Secretary was authorized to pack, box, and send the corn exhibit to Col. C. J. Murphy, Edinburg, Scotland, and pay all expenses to New York.

The Committee on Corn Awards was permitted to complete their report, and report same to the Secretary.

The following report was afterwards handed the Secretary:

AWARDS, WINTER CORN EXHIBIT, JANUARY 20, 1891.

Exhibitors and Varieties Shown.	Average length of ears.	Circumference of ears.	Shape on basis of 100.	Weight in pounds and ounces, three ears.	Ounces of cob in three ears.	Per cent of net grain to cob.	Color, uniformity, grain.	Quality and ripeness.	Weight one bushel shelled corn.
LARGE YELLOW DENT.				*Lbs. Oz.*					
F. M. Young, Murray	9.83	7.83	88	2 13	....	84	190	190	54¼
C. B. Smith, Blair	9.25	7	79	2 7	6	84	160	186	57¾
Geo. A. Slayton, Salem	9.33	6.83	75	2 8	4	90	170	170	54
M. H. Smith, De Soto	9.50	6.83	76	3	10	79	160	174	56¼
E. R. Todd, Plattsmouth	9.58	6.66	70	2 5	5	85	124	180	58
H. Thomas, Plattsmouth	8.83	6.75	78	2 6	5	86	120	160	57¼
SMALL YELLOW DENT.									
R. S. Briggs, Blair	7.08	6.41	97	1 9	3	88	196	196	56¾
M. H. Smith, De Soto	8	6.58	80	2	3½	90	170	190	58
Lee Smith, De Soto	7.25	7.04	85	1 14	3	90	180	190	57¾
Lee Smith, De Soto	7.87	6.87	90	2 2	4	88	150	190	55
*J. C. Cummins, Plattsmouth	....	....	......	....	....	......	....	....	....
†R. Hogue, Crete	....	....	......	....	....	......	....	....	....
†J. Pearson, Ashland	....	....	......	....	....	......	....	....	....
LARGE WHITE DENT.									
Lee Smith, De Soto	10	7.20	95	3	7	89	190	190	56½
Geo. A. Slayton, Salem	9.83	7.16	95	2 11	6	84	190	190	55
M. H. Smith, De Soto	9.41	7.58	90	3 1	7	89	180	190	55½
H. W. Detwiler, Raymond	8	7.33	85	2 3	4½	87	180	190	55
David Young, Plattsmouth	10.08	6.75	85	2 13	8½	81	170	180	57½
J. Giles, Lincoln	9.24	8.83	85	2 7	6	84	180	180	52½
*R. W. Black, Plattsmouth	....	....	......	....	....	......	....	....	....
*L. W. Murray, Plattsmouth	....	....	......	....	....	......	....	....	....
SMALL WHITE DENT.									
Lee Smith, De Soto	7.83	7	95	2 5	5	88	190	190	56
J. Pearson, Ashland	8.66	7.16	92	2 8	6	85	180	190	57
M. H. Smith, De Soto	8.25	7.16	90	2 6	5	87	180	190	54½
MIXED DENT.									
U. Cachlin, De Soto	9.16	7.79	95	3 1	8	83	190	190	54½
H. Seltz, De Soto	9.08	7	88	2 9	5½	86	176	190	54½
F. M. Young, Murray	9.66	7.08	90	2 11	6	86	150	170	56
CALICO DENT.									
M. H. Smith, De Soto	8.50	7.12	90	2 4	5	86	180	190	54¼
H. D. Leonard, Lincoln	9.16	6.54	88	2 3	6½	80	170	190	54½
*L. C. Murray, Plattsmouth	....	....	......	....	....	......	....	....	....
HACKBERRY DENT.									
C. B. Smith, Blair	8.75	7.83	95	2 13	7	84	190	190	54
H. Seltz, De Soto	8.83	7.16	90	2 6	5½	85	180	190	58
NAMED STRAINS YELLOW.									
Jacob King, Papillion	10.16	6.51	95	2 8	5	87	194	198	58¾
HOGUE'S YELLOW DENT.									
W. Grimm, Roca	9	7.75	95	2 13	6	86	190	190	55¼
R. Hogue, Crete	9.25	7.12	90	2 9	5	86	180	190	55¾
SMITH'S YELLOW DENT.									
M. H. Smith, De Soto	8.75	7.58	85	2 10	6	86	180	190	55½
MAMMOTH CUBAN.									
Lee Smith, De Soto	8.50	7	85	2 6	5	87	160	190	58½

*Not scored, no shelled corn.

†Ruled out by judges, not small yellow dent.

AWARDS, WINTER CORN EXHIBIT, JANUARY 20, 1891—CONCLUDED.

EXHIBITORS AND VARIETIES SHOWN.	Average length of ears.	Circumference of ears.	Shape on basis of 100.	Weight in pounds and ounces, three ears.	Ounces of cob in three ears.	Per cent of net grain to cob.	Color, uniformity, grain.	Quality and ripeness.	Weight of one bushel shelled corn.
NAMED STRAINS YELLOW MASTODON.				*Lbs. Oz.*					
Allen Root, Omaha	8.41	7.66	85	2 8	5½	86	170	170	54½
YELLOW DENT IMPROVED.									
F. J. Barnum, Waverly	8.41	6.75	80	2	5	84	170	176	55½
EARLY CALIFORNIA.									
E. J. Barnum, Waverly	8	7	80	2 1	4½	86	170	170	52½
IMPROVED CALIFORNIA.									
E. J. Barnum, Waverly	7.66	6.79	75	2	4½	86	160	170	57
NAMED STRAINS EARLY WHITE PEARL.									
Lee Smith, De Soto	9	6.66	95	2 7	6	84	190	190	58¼
ST. CHAS. WHITE DENT.									
Geo. A. Slayton, Salem	8.66	7.87	90	2 9	5½	87	190	180	54½
V. A. Jones, Waverly	9	6.75	90	2 7	7	82	190	190	56½
SMITH'S WHITE DENT.									
M. H. Smith, De Soto	8.66	7.50	95	2 13	6½	86	190	180	55
SMITH'S LARGE WHITE.									
A. P. Seymour, Unadilla	8.50	7	85	2	6	81	170	180	55¼
SMITH'S SMALL WHITE.									
A. P. Seymour, Unadilla	8.33	7	80	1 15	4	87	170	160	54½

PREMIUMS.

The following premiums were awarded:

Large Yellow Dent—First premium, F. M. Young, Murray; second, C. B. Smith, Blair.

Small Yellow Dent—First premium, R. S. Briggs, Blair; second, M. B. Smith, De Soto.

Large White Dent—First premium, Lee Smith, De Soto; second, Geo. A. Slayton, Salem.

Small White Dent—First premium, Lee Smith, De Soto; second, James Pearson, Ashland.

Mixed Dent—First premium, N. Cachlin, De Soto; second, Harry Seltz, De Soto.

Calico Dent—First premium, M. H. Smith, De Soto; second, N. C. Leonard, Lincoln.

Hackberry Dent—First premium, C. B. Smith, Blair; second, Harry Seltz, De Soto.

Named Strain Yellow Dent—First premium, W. Grimm, Roca; second, R. Hogue, Crete.

Named Strain White Dent—First premium, Lee Smith, De Soto; second, Geo. A. Slayton, Salem.

Sugar Corn—First premium, Fred. Hudson, Saltillo; second, Harry Thomas, Plattsmouth.

Popcorn—First premium, R. Hogue, Crete; second, A. P. Seymour, Unadilla.

Largest Ear of Corn—First premium, Lee Smith, De Soto; second, F. M. Young, Murray.

Largest Number of Varieties—First premium, A. P. Seymour, Unadilla; second, Lee Smith, De Soto.

FRANK M. YOUNG,
J. B. McDOWELL,
A. E. BAKER,
Committee.

REPORT OF COMMITTEE ON TESTS OF MILCH COWS.

Hon. R. W. Furnas, Secretary State Board of Agriculture: Your committee in charge of tests of milch cows at Nebraska State Fair for the year 1890 would respectfully submit the following report:

There were nine (9) entries in this class, which includes the entries for the special premiums offered by the Short-Horn Breeders' Association for milch cows of that breed. The following is a summary of the results of the test. So far as one could judge there was nothing of the "professional" on the part of the owners, in the way these cows were fed or cared for. Of the cows four years old and over, all were fresh between June and August except the cow Goldleaf II, who was fresh in June, 1889, and not bred. For cows four years old and over first premium was awarded the Holstein cow, Goldleaf II; second premium, Short-Horn cow, 5th Mistletoe of the Grove. There is but one entry of three year olds.

Jersey—Caryl II, age three years. Owner, Geo. B. French, Fremont, Neb.

		Pounds.		Pounds.
Sept. 9.	Milk	12 14-16	Butter	.62
Sept. 10.	Milk	10 12-16	Butter	.52
	Total	23 10-16	Total	1.14

Grade Cow—Fawn II, age four years. Owner, A. G. Porter, Lincoln, Neb.

		Pounds.		Pounds.
Sept. 9.	Milk	29 5-16	Butter	.97
Sept. 10.	Milk	28 7-16	Butter	.85
	Total	57 12-16	Total	1.82

Jersey—Pride's Fleta, age five years. Owner, Geo. B. French, Fremont, Neb.

		Pounds.		Pounds.
Sept. 9.	Milk	25 7-16	Butter	.92
Sept. 10.	Milk	25 8-16	Butter	.99
	Total	50 15-16	Total	1.91

Jersey—Katrine, age seven years. Owner, Geo. B. French, Fremont, Neb.

		Pounds.		Pounds.
Sept. 9.	Milk	17 9-16	Butter	.84
Sept. 10.	Milk	18 2-16	Butter	.88
	Total	35 11-16	Total	1.72

Jersey—Caryl, age seven years. Owner, Geo. B. French, Fremont, Neb.

	Pounds.		Pounds.
Sept. 9. Milk	24 14-16	Butter	1.02
Sept. 10. Milk	24 2-16	Butter	1.05
Total	49	Total	2.07

Holstein—Goldleaf II, age five years. Owner, C. F. Stone, Peabody, Kan.

	Pounds.		Pounds.
Sept. 9. Milk	49 3-16	Butter	1.65
Sept. 10. Milk	49 3-16	Butter	1.53
Total	98 6-16	Total	3.18

Holstein—Empress Josephine, age ten years. Owner, C. F. Stone, Peabody, Kan.

	Pounds.		Pounds.
Sept. 9. Milk	47 12-16	Butter	1.35
Sept. 10. Milk	49 2-16	Butter	1.22
Total	97 14-16	Total	2.57

Short-Horn—Anna Laura, age eight years. Owner, T. R. Daniels, Gilmore, Neb.

	Pounds.		Pounds.
Sept. 9. Milk	26 12-16	Butter	.78
Sept. 10. Milk	27 8-16	Butter	.89
Total	54 4-16	Total	1.67

Short-Horn—Maggie Gunter, age four years. Owner, R. H. Daniels, Gilmore, Neb.

	Pounds.		Pounds.
Sept. 9. Milk	24 4-16	Butter	.75
Sept. 10. Milk	23 2-16	Butter	.78
Total	47 6-16	Total	1.53

Short-Horn—Clara B., age nine years. Owner, B. O. Cowan, New Point, Mo.

	Pounds.		Pounds.
Sept. 9. Milk	33 1-16	Butter	1.17
Sept. 10. Milk	26 7-16	Butter	.99
Total	59 8-16	Total	2.16

Short-Horn—5th Mistletoe of the Grove, age ten years. Owner, J. Russell Lownes, Lincoln, Neb.

	Pounds.		Pounds.
Sept. 9. Milk	32 7-16	Butter	1.46
Sept. 10. Milk	28 9-16	Butter	1.27
Total	61	Total	2.73

S. C. BASSETT,
Superintendent Class B, Lot 13.

APPENDIX.

CROP AND OTHER AGRICULTURAL PRODUCTS REPORT, FOR THE YEAR 1890.

In preparing these reports I aim to present them as full and complete as possible; and yet it is short of what is desired, or should be. It is believed to be as near correct, however, as can be made under existing circumstances. The compilation is made from official state and county records, reports from district and county agricultural associations, and correspondents in each organized county—principally from official records. The values, average and general, of lands, both improved and unimproved, and live stock, are entire from official returns and records. These, it must be remembered, are made for taxable purposes, and, as can readily be seen, are far below actual cash values. In the opinion of the compiler this is a mistaken policy, and works injury. The law provides otherwise, and should be enforced.

CROP AND OTHER AGRICULTURAL PRODUCTS REPORT, 1890.

COUNTY.	REAL ESTATE—LANDS.						Assessed Valuation of Property.	Wheat.		Corn.		Oats.	
	Improved.			Unimproved.									
	Acres.	Value.	Av.	Acres.	Value.	Av.		Acres.	Bus.	Acres.	Bus.	Acres.	Bus.
Antelope	145632	$370891	$2 54	291936	$451163	$1 54	$1634277 37	2871	14355	44431	355648	9254	92540
Adams	234500	952996	4 06	94442	210073	2 22	3894179 85	27960	391440	98465	1476975	40196	803920
Arthur	...	...	...	...	...	...	...	...	...	...	...	...	...
Buffalo	397635	908745	2 28	124402	209650	1 68	3653452 56	17500	...	81150	...	37500	...
Blaine	5541	20789	3 75	24736	55363	2 23	214119 00	135	...	4613	...	417	...
Box Butte	29810	57407	1 92	170540	333374	1 95	907553 87	...	...	...	...	...	...
Boone	115525	331917	2 87	252280	451737	1 80	1578230 20	21000	315000	63000	315000	25000	725000
Brown	52141	130689	2 50	172767	133602	77	635598 46	22061	330915	34007	850175	4215	84300
Burt	164408	721788	4 39	127978	334825	2 61	1982893 50	5371	80565	70337	2110110	11098	388430
Butler	228869	881792	3 85	124889	335136	2 68	2564261 05	2235	...	106380	...	48960	...
Banner	9952	19269	1 93	137047	224994	1 64	326952 00	...	...	...	...	...	...
Cass	333599	2316784	6 94	...	...	...	5214501 21	12185	219330	113828	2841700	19031	475775
Cheyenne	14358	22950	1 59	457296	509919	1 11	1284132 85	1990	...	1500	...	242	...
Cherry	17810	32479	1 82	135334	120147	89	1057492 70	2000	36000	7000	175000	1000	30000
Chase	115000	295654	2 57	120722	150902	1 25	711378 00	48576	...	42882	...	11172	...
Cedar	86369	354021	4 09	312037	1160614	3 71	1966628 70	7495	...	33794	...	11629	...
Clay	236601	1002360	4 23	104888	316585	3 01	3112256 70	6757	...	116478	2329560	42203	844060
Colfax	89156	407792	4 57	155597	603563	3 88	1910016 80	10000	120000	60000	2100000	20000	300000
Cuming	160375	670434	4 18	156818	516702	3 29	2046135 78	63929	11507227	144111	5764440	23481	704430
Custer	259734	432750	1 66	603994	548532	90	2083181 20	...	...	...	...	...	...
Dawson	168667	296313	1 75	332933	399519	1 19	1640278 07	21811	...	40930	...	11601	...
Dawes	31133	318501	10 22	147077	225324	1 53	1862695 4[illegible]	...	...	...	...	...	...
Dakota	95423	527236	5 52	50943	296114	5 81	1869427 50	6586	98790	48644	2443200	5000	300000
Dixon	116225	412599	3 55	154250	488212	3 16	1417651 00	4245	...	54878	...	13263	...
Dodge	196787	768226	3 90	124697	384113	3 08	3176863 97	9280	185600	85760	3430400	26320	658000
Douglas	120750	1919928	15 90	66089	1287365	19 47	25042329 01	3430	...	49876	...	13577	...
Dundy	38112	166917	4 37	157291	166917	1 06	790980 35	9528	...	19056	...	3176	...
Deuel	17082	33263	1 94	266077	405472	1 52	870163 75	828	...	939	...	159	...
Fillmore	260902	948953	3 63	88007	267405	3 03	2910066 17	15144	242304	131119	1311190	64999	1949970
Franklin	111447	254953	2 28	217528	293797	1 35	1121077 40	22000	110000	56000	280000	20000	300000
Frontier	132850	455887	3 43	217477	227944	1 04	1257684 57	...	...	...	...	...	...
Furnas	120766	253253	2 09	252320	403591	1 59	1399291 37	26340	26340	84717	10590	68847	...
Gage	388578	1722210	4 43	116718	448525	3 84	5263012 75	11333	226660	151129	3778125	38018	840540
Garfield	14906	36350	2 43	72717	76326	1 04	222966 00	1432	14320	8256	8256	1494	7420
Grant	170	460	2 70	4428	7525	1 69	198572 47	...	...	100	...	...	...
Greeley	92000	331200	3 60	196465	374847	1 90	1104680 40	15850	317000	47495	949900	24875	746250
Gosper	76342	229917	3 01	143717	321639	2 24	822591 82	12050	...	25888	...	5024	...
Hall	214508	808680	3 76	93244	284796	3 05	3169456 76	3269	32690	11082	110820	28203	507654
Hamilton	252346	786800	3 11	69550	147069	2 11	2098662 40	3556	...	119237	...	48960	...
Harlan	81219	194926	2 40	237948	392889	1 65	1360105 09	20000	160000	40000	400000	12000	240000
Hayes	50736	253680	5 00	152208	283764	1 86	742954 00	12788	63940	49779	...	3262	...

Hitchcock	72029	164652	2 28	185093	308331	1 66	1073166 15	....	....	....	....	....
Holt	197980	507150	2 56	656816	1295725	1 97	2863649 52	20000	320000	100000	2500000	25000	750000
Howard	137293	390608	2 85	161745	288491	1 78	1600591 20	18241	364820	58462	801980	18053	324954
Hooker	408	1599	3 96	4009	178467	2 11	155254 95	39	....	2000	....	100	....
Jefferson	168973	753898	4 46	179072	588847	3 28	2736116 17	9822	....	99838	....	24732	....
Johnson	176935	894169	5 05	55583	222972	4 00	2097566 75	....	....	....	....	....	....
Keith	31288	70398	2 25	366720	581859	1 45	1309168 02	15000	30000	2500	50000	1000	....
Kearney	174895	378212	2 16	115122	150215	1 30	1455418 35	49782	357381	60660	119188	21856	393408
Keya Paha	37904	100025	2 64	162189	262756	1 62	516688 00	4091	....	13179	....	1578	....
Knox	69000	207000	3 00	353009	855178	2 42	1502000 20	38990	584850	92105	3681200	41470	165880
Kimball	8040	11599	1 44	306551	324978	1 06	840771 29	3000	....	2000	....	1000	....
Lancaster	293444	1587645	5 41	184269	807421	4 38	10107950 35	3217	32170	155261	3105220	43095	1077375
Lincoln	62507	191348	3 06	745650	932060	1 25	2696714 12	11944	....	25000	....	4000	....
Loup	9026	35405	3 92	35794	71122	1 99	198809 00	2206	22060	8449	337960	5175	207000
Logan	11569	41880	3 70	50291	156913	3 12	851893 00	1446	....	8677	....	723	....
Madison	155290	789478	5 08	168119	633015	3 80	2837278 88	9323	122168	77415	1935475	29207	11315315
Merrick	127965	441278	3 44	144422	393855	3 06	2112321 09	5550	83250	81635	4081750	42000	1680000
McPherson	738	1687	2 10	51017	105314	2 33	158691 00	46	....	255	....	8	....
Nance	100641	276634	2 75	128854	236624	1 84	1073827 00	1489	13512	48294	965880	10411	32275
Nemaha	230164	1198396	5 26	11163	39814	3 56	2479409 33	10497	....	67404	....	13133	....
Nuckolls	155238	588651	3 66	185501	589871	3 18	2669664 47	5341	....	14752	....	18357	....
Otoe	359994	2581039	7 17	18430	99739	5 44	5158615 83	10756	129072	112182	3364860	22547	891880
Pawnee	122682	704566	5 74	136667	567961	4 16	2485919 36	1500	15000	75000	1500000	25000	500000
Perkins	54082	118384	2 18	248538	463556	1 86	1012658 87	60000	600000	25000	25000	3000	3000
Phelps	173527	346821	2 00	122977	212877	1 79	1285432 35	28529	427935	45411	2270550	14653	686120
Pierce	70209	229373	3 26	225069	631690	2 80	1812877 80	....	....	....	....	....	....
Platte	192844	623997	3 24	202608	447168	2 20	2580110 02	18096	235248	95104	951040	41208	824160
Polk	215839	760623	3 52	38052	112638	2 96	1538740 95	1000	....	30000	....	28000	....
Red Willow	90107	167305	1 86	242754	321113	1 31	1357266 07	14361	....	34363	....	3916	....
Richardson	290600	1684441	5 79	35000	79644	2 27	3245082 09	46900	469000	129600	3240000	129600	2851200
Rock	30764	69219	2 25	123056	200104	1 63	503522 43	2870	34540	15430	462900	1250	25000
Saline	272970	968284	3 54	80525	221215	2 77	2960878 50	13159	263180	119021	1119021	101987	2039740
Sarpy	92650	717835	7 74	46711	260463	5 57	1973898 21	2880	34260	58400	2336000	16770	503100
Saunders	342086	1133853	3 31	114029	228038	1 99	3301461 22	26840	....	245621	....	45460	....
Sioux	11384	25935	2 27	62963	94353	1 49	517406 95	465	....	1887	....	435	....
Seward	334096	1458352	4 36	16559	39855	2 33	2897969 25	3454	69080	100 944	1000 37760	33863	1358520
Sherman	60000	150000	2 50	238000	409678	1 72	1112362 00	10499	....	34034	....	9044	....
Sheridan	82100	274770	3 31	166817	183681	1 10	1301262 73	32840	....	24630	....	16500	....
Stanton	69012	228861	3 31	271487	565254	2 08	1166379 04	8569	....	28773	....	6653	....
Scott's Bluff	5463	12610	2 30	62029	115387	1 85	241050 00	493	9860	1433	....	478	19120
Thayer	180627	708259	3 81	165257	492908	2 98	2471228 40	11598	208764	93655	4595410	20989	757404
Thomas	1519	5409	3 56	9970	20929	2 09	186680 75	....	....	2783	2783	....	....
Thurston	15161	37284	2 45	10978	25999	2 37	279189 70	1168	....	7128	....	1575	....
Valley	73657	193687	2 63	212234	349142	1 64	1083351 40	7289	....	28009	....	6564	....
Washington	207853	742018	3 57	28097	291080	10 36	2038994 46	8000	120000	44800	12404	8000	320000
Wayne	118044	554863	4 70	130675	500196	3 82	1675005 00	10000	....	30000	....	7000	....
Webster	189610	594683	3 14	131890	276681	2 10	2074647 40	8982	53792	61016	....	14827	....
Wheeler	15074	39203	2 60	90067	165137	1 88	319740 00	559	11180	6768	67680	1855	33875
York	279005	1100725	3 09	75071	149657	1 82	2808377 84	8590	....	108543	....	37442	....

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COUNTY.	Barley.		Meadow.	Flax.		Rye.		Potatoes.		Miscellaneous.	Number of		
	Acres.	Bus.	Acres.	Acres.	Bus.	Acres.	Bus.	Acres.	Bus.	Acres.	Fruit Trees.	Forest Trees.	Grape Vines.
Antelope	105	680	1072	95	880	566	2264	86	6880	170	14253	2682515	316
Adams	16416	328320	21732	2500	25000	520				512	99630	3218060	15540
Arthur													
Buffalo	1500		1000								85000	4779550	12500
Blaine											7109	21173	
Box Butte													
Boone	1000	30000	700	2000	20000	150	4500	500	12500	2000	15000	2000000	3500
Brown	1061	21220	260	250	3750	7608	152160	85		15	11246	1163023	4152
Burt	403	12090	29893	237	237	50	900	8648	129720	1201	61572	2716746	11788
Butler	150		13005					5000			183900	2773000	26070
Banner													
Cass	4361	109025	68026					1585			129186	1151570	57705
Cheyenne	74		1900								160	1400	48
Cherry	100										160	2000	10
Chase	2520		8492	8270		2238					36790	4841800	4520
Cedar	596		3492								4849	482571	2500
Clay	4938	49330	34331	10910	87280	1507	15070	300	6000	194	98028	2923820	15601
Colfax	2000			15000	120000	10000	200000				15000	1000000	35000
Cuming	3000		17351	5000		2000				1500	40000		30000
Custer													
Dawson	1059		1557								10586	489018	6618
Dawes													
Dakota	200			1000	12000	1000	10000	1000	250000		19487	546320	4194
Dixon	2065		87863	3070							20142	4440000	10000
Dodge	1025	25625	37290	25	300	320	8000	150	4500	1012	47287	185965	17520
Douglas	3335		81249	10		505		1553		2138	61689	1579850	89047
Dundy	3176		3176					1553			10071	2808000	6447
Deuel	80					81				228	98	8110	50
Fillmore	773	15460	22799	5175	54750	965	24025	3440	51600	90	149297	2468814	29069
Franklin	5500	55000		2000	8000	5500	55000	2000	40000				
Frontier	2000	8000		2000	6000	2500	20000	1500	3000		12000	5000	5000
Furnas	475	950				10000	50000	12000	2000				
Gage	163	4890	38341	24234	205404	1546	30920	736	29440		1907328	229462	67121
Garfield	75		550			105	1050	410	2050		5009	166422	2501
Grant												150	
Greeley	900	37800	10000	1800	30600	1500	52500	47500	71250		4515	706500	1080
Gosper	414		222	530	5300			192	1920	1232	10913	793090	1890
Hall	8869	159642	8968	120	480	2400	20200	3421	102680	547	47472	1650085	16170
Hamilton	2057		37593	14370		203				142	97731	2687461	52206
Harlan	3500	35000				10000	100000	2000	40000				
Hayes	300		4000	4500		3000	33000	2000	10000		11855	525888	10849

Hitchcock													
Holt	10000	250000	5000	500	4500	25000	625000	2500	12500	12980	500000	80000000	150000
Howard	1400	44800	10972	400	2000	4250	434000	750	7500		280600	1249507	4401
Hooker											800	1000	100
Jefferson	473		13342	255		235				310	125782	1351908	32299
Johnson													
Keith	1000			100		200	1000	100	1500		10000	1000000	500
Kearney	8683	130245	7519	6555	39885	4104	55454	3000	90000	254	44925	1903169	3406
Keya Paha	146		146	145		2642				64	7923	497000	1364
Knox	4706	141180	1800	9459	84122	9500	142500	5000	600000	800	11000	5600000	4650
Kimball	100												
Lancaster	448		55819	913						568	181174	2448805	46450
Lincoln	1000		2000								8000	2230150	2000
Loup	2		282			1030	30900	400	4000		8070	73101	142
Logan						728					5000	100000	500
Madison	1183	35490	14368	1461	11688	122	2440			1570	20652	3552023	16510
Merrick	800	24000	2200	1000	18000	2000	60000	5000	500000		38159	2517350	7700
McPherson			2								45		
Nance	488	9760	3208	2060	16480	1123	22460	500	25000	534	15975	275790	3515
Nemaha	765		41998					29		11707	185379	1296937	28302
Nuckolls	770		3405	3438		810				593	67059	1933019	14885
Otoe	10317	309510	24427	402	2412	1650	22000	1200	72000		182718		68824
Pawnee			12000	3500	17500	200	2000	3000	150000		120000	800000	50000
Perkins	500	2500	100	400	1200	1000	10000	600	6000		3000	10000	500
Phelps	1851	37020	923	1791	17910	358	7160			1339	24009	1682800	1697
Pierce													
Platte	4116	123480	8410	3717	37170			2000	60000		47000	4150000	20150
Polk	1000		6000	6000		1000				1500	60000	3000000	11000
Red Willow	242		2311			446				228	20492	1787568	5540
Richardson	11300	226000				11300	113000	2400	12000		460200	5184000	102592
Rock	220	4400	110	100	1000	1500	27000	840	84000	305	9800	85080	125
Saline	1517	30340	26982	2172	4344	2481	24810	3500	150000	580	148566	1226598	39852
Sarpy	8400	68000	2000	6000		3000	30000	3000	120000	3200	56370	1200000	28
Saunders	986		22840			4800		2700		3380	250500	1890600	75000
Sioux	20		28	45						39	248	2420	50
Seward	532	10640	31847	2347	23470	2000	40000	3000	30000	278	136498	1369863	44361
Sherman	421		310							2232	14504	602118	2143
Sheridan	6130		1000								750	240	10
Stanton	472		1288	634		225				120	8727	1160500	15548
Scott's Bluff	121	8630	14					529	5290	175		870	
Thayer	794	23820	2226	2441	17087	1772	35440	70	8100	308	97058	928871	4230
Thomas			100	50	250			100	1000		1039	430	32
Thurston	167		201	40		6				310	4475	222750	2018
Valley	769		8543	301							116067	1624673	2140
Washington	10000		67000	300	1500	500	8000	2100	168000		100000	100000	500000
Wayne	500		1000								5000	1000000	6000
Webster	1576		1139								35774	671381	5608
Wheeler	27		806			214	4280				8813	631566	499
York	1612		23347	15869		580				206	101031	2281272	22010

CROP AND OTHER AGRICULTURAL PRODUCTS REPORT, 1890—CONCLUDED.

COUNTY.	HORSES.			CATTLE.			MULES AND ASSES.			SHEEP.			HOGS.		
	No.	Value.	Av.	No.	Value.	Av.	No.	Value.	Av.	No.	Value.	Av.	No.	Value.	Av.
Antelope	6939	$133026	$19 17	18588	$99977	$5 38	520	$10038	$19 30	907	$558	$0 61	21575	$25051	$1 16
Adams	8103	129647	16 00	20691	87274	4 22	889	16273	18 31	1226	717	58	23272	24928	1 07
Arthur															
Buffalo	12767	171972	13 48	39389	140312	3 56	922	13513	14 66	12547	13204	1 05	48324	46928	1 08
Blaine	1000	14676	14 67	2790	13155	4 71	58	2174	37 48	138	76	54	2598	2953	1 13
Box Butte	3268	57950	17 73	5996	36313	6 05	388	8841	21 76	32	33	1 03	2257	2247	99
Boone	6473	133782	20 67	19083	99384	5 20	334	6772	20 28	2346	725	30	27229	30593	1 12
Brown	2669	41945	15 71	6663	25858	3 88	122	2280	18 69	499	499	1 00	4987	5380	1 08
Burt	9096	155646	17 11	33901	171092	5 04	790	16029	20 29	662	451	68	30047	34119	1 13
Butler	10268	128555	12 52	27794	83938	3 02	679	9452	18 92	182	88	48	29865	24788	83
Banner	2060	30091	14 60	3816	20024	5 24	168	3548	21 11	122	135	1 10	1051	1134	1 07
Cass	12143	237124	19 54	33954	167684	4 93	1231	25677	20 86	277	241	89	51563	66685	1 29
Cheyenne	4901	54614	11 14	11641	45912	3 95	367	5842	15 92	4684	2260	48	1427	1272	89
Cherry	6006	87857	12 96	26884	108959	4 05	312	6528	20 92	1358	900	66	5525	3930	72
Chase	3314	61379	18 52	6108	30492	4 99	313	7406	23 66				8748	9093	1 03
Cedar	5769	57637	9 99	24076	49458	2 05	236	2806	11 89	157	79	50	16843	11102	65
Clay	10929	158719	14 52	30028	112164	3 73	746	11973	16 05	1251	834	66	38625	38587	99
Colfax	6026	102433	17 00	23613	89043	3 79	412	1021	2 48	1534	653	42	20937	18584	88
Cuming	8544	123840	14 49	33133	107087	3 23	728	12183	16 73	1668	839	50	32771	31728	97
Custer	16551	185148	11 18	31118	112567	3 61	1331	17326	13 01	1891	678	35	62106	58941	94
Dawson	9768	89739	9 18	20948	57461	2 74	714	7543	10 56	832	115	13	28738	17314	60
Dawes	5525	156819	28 78	10632	74154	6 97	482	11710	24 29	796	1995	2 50	3430	3407	99
Dakota	3557	81572	22 93	13774	69206	5 02	401	12190	30 39	39	27	69	13702	14664	1 07
Dixon	5606	87229	15 56	19505	77030	3 95	359	5230	14 56	433	240	55	14239	12892	90
Dodge	8987	170859	19 01	31967	136485	4 27	789	15178	19 23	4966	3656	70	21922	20130	91
Douglas	11388	260171	22 84	18294	122075	6 67	1197	29622	24 74	768	1983	2 58	15874	20648	1 30
Dundy	2806	59900	21 34	6290	34302	5 45	234	6223	26 59	806	402	49	7381	9166	1 24
Deuel	2609	36465	13 55	9339	46750	5 00	176	3220	12 61	3296	1693	51	1090	1123	1 03
Fillmore	11333	145392	12 91	28272	123628	4 37	842	12286	14 59	757	386	50	38004	43906	1 15
Franklin	5985	71648	11 97	16030	44757	2 79	409	5683	13 89	1311	379	28	24162	23940	99
Frontier	7414	124407	16 78	16553	85587	5 17	520	11159	21 46	196	108	55	24181	26491	1 09
Furnas	8278	86461	10 44	16358	45257	2 76	413	5418	13 11	109	38	34	27565	16990	61
Gage	18477	246733	13 35	49930	185068	3 70	1608	23951	14 70	9877	6461	65	60013	53966	89
Garfield	1166	21231	18 20	2971	15084	5 07	73	1970	26 98	216	213	98	3797	3563	93
Grant	508	10620	20 90	5492	40698	7 22	31	852	27 48				169	416	2 46
Greeley	2828	42396	15 13	6922	24530	3 54	271	4462	16 46	362	185	51	10735	8192	76
Gosper	3999	58445	14 65	7898	25035	3 17	301	5276	17 53	15	8	53	13056	11763	90
Hall	8075	107647	13 33	29736	85718	2 88	912	14320	15 70	14277	6695	46	25506	22506	88
Hamilton	9785	170253	17 39	32874	151956	4 62	804	16001	19 90	468	408	87	34973	32706	93
Harlan	6227	60600	9 87	17391	61200	3 51	361	4033	11 17	5273	2651	50	21309	21536	1 01
Hayes	3485	70716	20 29	6995	38263	5 47	343	8622	25 13				12814	13948	1 08

Hitchcock	4606	67989	14 76	8469	39826	4 69	486	6603	13 58	191	67	50	13088	14609	1 11
Holt	9226	170476	17 07	29621	130763	4 41	618	129.6	20 90	4138	1919	48	17318	19304	1 12
Howard	5194	99758	19 20	15705	63184	4 02	516	10129	20 21	21	18	62	20695	17284	83
Hooker	224	4204	18 76	731	5190	7 10	19	498	25 90	2	1	50	551	884	1 51
Jefferson	10245	138764	13 54	30171	111022	3 68	907	13076	14 41	2613	1257	48	34741	32165	92
Johnson	8361	145045	17 34	23186	107847	4 65	594	12846	21 62	1157	581	50	24880	28386	1 13
Keith	2157	36442	16 89	8045	33714	4 19	152	2947	19 39	2504	1284	51	3061	3579	1 17
Kearney	6917	81420	11 77	17129	52876	3 08	551	6968	12 63	16504	10223	62	28804	19901	84
Keya Paha	3007	47849	15 91	9003	37314	4 14	232	5318	22 92	1006	1006	1 00	5450	6030	1 11
Knox	4689	96705	20 62	16725	70823	4 23	396	8672	21 89	1102	1246	1 13	12845	11775	91
Kimball	692	5796	8 37	2137	7818	3 65	74	769	10 89	482	176	36	111	121	1 09
Lancaster	17334	250740	14 46	45405	209905	4 62	1278	19449	15 21	4437	2767	62	62997	50396	79
Lincoln	8797	80904	9 16	24184	71391	2 91	379	4940	13 04	3755	1377	37	11942	10440	88
Loup	1298	22252	17 14	3174	14472	4 56	77	1868	24 26	1	1	1 00	4144	5586	1 35
Logan	1276	36798	28 83	2899	23331	8 04	99	3930	39 52	29	29	72	8721	9479	2 55
Madison	8155	115995	14 22	28229	111426	3 94	600	8728	14 54	775	421	54	25519	26928	1 05
Merrick	6200	83692	13 49	25697	110068	4 28	347	4840	13 92	16003	7714	48	19111	23445	1 22
McPherson	583	14629	25 51	3379	30813	9 30	32	1130	35 40	....	....	....	366	860	2 50
Nance	4444	55194	12 42	18677	71587	3 88	519	6212	11 97	652	164	25	17691	11771	66
Nemaha	8765	178129	20 32	29155	146746	5 03	1041	25516	24 51	659	328	50	30942	38928	1 24
Nuckolls	7811	127952	16 00	26303	142227	6 00	760	14423	19 00	2560	737	29	31259	37201	1 00
Otoe	12261	233044	19 00	37900	170901	4 50	1563	30291	19 38	2225	1959	88	47428	52658	1 11
Pawnee	8176	161003	19 70	30751	125315	4 08	1434	9420	21 70	2677	1963	73	27616	33716	1 22
Perkins	2859	48937	17 16	4876	21058	4 31	327	7028	21 49	33	19	59	6211	5956	95
Phelps	7480	93101	12 44	18704	45051	2 40	548	7760	14 10	533	267	50	25325	16367	65
Pierce	4028	72727	18 05	12696	66069	5 20	348	7830	22 21	3253	2849	87	11481	12066	1 05
Platte	9059	160154	17 67	28656	143413	5 00	431	7658	17 76	12409	7818	63	34459	18588	54
Polk	8017	130498	16 25	22051	82066	3 72	684	11761	17 48	2141	1281	59	31204	35249	1 12
Red Willow	6142	76562	12 46	13523	49816	3 68	407	6831	16 78	310	110	35	15839	16425	1 04
Richardson	12663	186610	14 75	36913	135525	3 69	1191	17748	14 90	2151	1123	52	40385	39050	97
Rock	2250	31880	14 16	7905	33725	4 26	140	2401	17 15	1355	750	55	2470	2800	1 13
Saline	12913	195101	15 07	32740	129990	3 97	680	11176	16 42	297	255	85	47085	54091	1 15
Sarpy	4889	108333	22 06	12376	64189	5 18	483	10864	22 70	242	270	1 11	13092	18958	1 44
Saunders	14447	227636	15 75	42823	183812	4 30	986	15697	16 00	430	294	70	49510	51615	1 10
Sioux	2595	53937	20 75	7388	64312	8 70	141	4047	28 70	256	140	55	938	917	98
Seward	11515	207287	17 13	30947	132372	4 21	824	15223	18 47	2595	3060	1 25	44216	52568	1 18
Sherman	4265	68878	16 15	10441	38080	3 65	307	5530	18 00	276	221	80	17257	14892	86
Sheridan	6798	114616	16 86	17249	85862	4 91	526	12288	23 35	651	327	50	5635	5838	1 03
Stanton	3584	62999	17 58	15583	73707	4 73	242	6171	25 50	2549	1292	50	15394	11853	77
Scott's Bluff	1741	29091	17 28	5094	25995	5 11	154	2977	18 67	252	127	50	508	658	1 29
Thayer	8407	158306	18 83	21907	95879	4 37	810	17936	22 14	1437	759	52	25617	30899	1 20
Thomas	306	3836	12 53	671	4765	7 10	34	556	16 35	....	....	....	470	541	1 15
Thurston	1759	24351	13 84	4255	27689	6 50	76	1948	21 68	9	8	84	2591	3551	1 37
Valley	5072	50457	9 95	13030	30828	2 37	309	3881	12 56	598	293	49	19940	14904	75
Washington	7609	117690	15 47	25346	82079	3 23	792	13780	17 40	286	163	58	33410	35685	1 07
Wayne	5313	92962	17 49	28617	105490	4 46	608	10582	17 40	2601	1344	51	16763	16103	96
Webster	7972	134888	16 92	25225	116083	4 60	595	12681	21 31	3192	1388	46	30413	34026	1 11
Wheeler	1618	33657	20 80	4613	32322	7 31	79	2384	29 54	246	468	1 90	3509	7113	2 02
York	11981	180142	15 36	34292	146649	4 28	917	15616	17 03	718	378	52	42499	45170	1 06

ANNUAL METEOROLOGICAL REPORT OF THE NEBRASKA WEATHER SERVICE FOR 1890.

BY GOODWIN D. SWEZEY, DIRECTOR, AND G. A. LOVELAND, SIGNAL CORPS, ASSISTANT.

This report is substantially a rearrangement of the data already published in the monthly bulletins of the Nebraska Weather Service for the year 1890. Reports received too late for publication in the bulletins have been here incorporated and the averages revised and modified when necessary; some slight discrepancies between the monthly bulletins and this annual report are to be thus accounted for. All available sources of information have been resorted to, and great care taken to avoid errors; it is believed that this report may be taken as a trustworthy and a tolerably complete statement of the meteorological conditions which have prevailed in the state during the year 1890.

STATIONS AND OBSERVERS.

As will be seen from the following table, the number of stations from which reports are received now reaches seventy-nine, and further, that they are well distributed throughout the state. They are more numerous, it is true, in the southeastern section than elsewhere, as they always have been, but they are not, as formerly, confined or nearly confined to that part of the state. Four of these are stations of the United States Signal Service, whose officers co-operate heartily with the Nebraska Weather Service; four others are United States military posts, whose reports we receive through a like courtesy on the part of the surgeon general of the United States army; ten others are stations of the Burlington & Missouri railroad, whose reports are furnished by the co-operation of Superintendent T. E. Calvert; the remaining volunteer stations are for the most part supplied either with standard United States rain-gauges or else with gauges of a similar pattern, manufactured specially for the Nebraska Weather Service; also with thermometers either of the United States Signal Service pattern, or else tested here at the central office by our standard thermometers.

LIST OF VOLUNTARY OBSERVERS WHO HAVE FURNISHED REPORTS FOR 1890.

Station.	*County.*	*Observer.*
Alliance	Box Butte	Dr. W. R. Lewis.
Ansley	Custer	Peter Fowlie.
Ashland	Saunders	Geo. Shedd.
Bassett	Rock	A. H. Gale.
Beaver City	Furnas	C. W. Malone.

Station.	*County.*	*Observer.*
Bingham	Sheridan	W. C. Wood.
Burwell	Garfield	H. N. Leach.
Craig	Burt	E. F. Irwin.
Crawford	Dawes	W. B. Anderson.
Creighton	Knox	Dr. Geo. Roberts.
Crete	Saline	C. E. Chadsey.
Culbertson	Hitchcock	John Bailor.
Culbertson	Hitchcock	Mrs. L. A. Wibley.
David City	Butler	E. B. Taylor.
De Soto	Washington	Charles Seltz.
Dunning	Blaine	H. C. Judson.
Elwood	Gosper	W. Ward.
Erickson	Wheeler	A. Dahl.
Fairbury	Jefferson	Dr. I. Humphrey.
Fairfield	Clay	P. B. Gaylord.
Falls City	Richardson	Robert Clegg.
Fort Niobrara	Cherry	Post Surgeon.
Fort Omaha	Douglas	Post Surgeon.
Fort Robinson	Dawes	Post Surgeon.
Fort Sidney	Cheyenne	Post Surgeon.
Franklin	Franklin	J. N. Bennett.
Fremont	Dodge	I. E. Heaton.
Geneva	Fillmore	R. B. Spear.
Genoa	Nance	G. S. Truman.
Gering	Scott's Bluff	J. P. Finley.
Grand Island	Hall	T. A. Watson.
Grant	Perkins	W. L. Rutledge.
Harvard	Clay	Dr. J. T. Fleming.
Hastings	Adams	O. F. Heartwell.
Hay Springs	Sheridan	Wm. Waterman.
Hebron	Thayer	Dr. C. M. Easton.
Holdrege	Phelps	Mrs. M. E. Randolph.
Howe	Nemaha	G. D. Carrington.
Imperial	Chase	J. M. Bird.
Kimball	Kimball	D. Henderson.
Kennedy	Cherry	Mrs. M. G. Erickson.
Lexington	Dawson	J. M. Tipton.
Lincoln	Lancaster	T. Brugger.
Long Pine	Brown	R. W. Blake.
Marquette	Hamilton	John Ellis.
Minden	Kearney	Joel Hull.
Mullen	Hooker	L. S. Trefun.
Nebraska City	Otoe	J. B. Parmelee.
North Loup	Valley	E. W. Black.
North Platte	Lincoln	Observer Signal Service.
Oakdale	Antelope	G. S. Clingman.
Omaha	Douglas	Observer Signal Service.

Station.	County.	Observer.
O'Neill	Holt	A. U. Morris.
Ough	Dundy	E. H. Talbot.
Palmer	Merrick	C. Shieldstream.
Paxton	Keith	Dr. R. D. Harris.
Plattsmouth	Cass	H. B. Burgess.
Precept	Furnas	H. Montgomery.
Purple Cane	Dodge	S. R. Mason.
Ravenna	Buffalo	E. Smith.
Sargent	Custer	J. S. Spooner.
Saronville	Clay	A. B. Hollenbeck.
Seward	Seward	W. J. Hayford.
Sioux City, Iowa		Observer Signal Service.
Superior	Nuckolls	S. Diller.
Syracuse	Otoe	P. W. Risser.
Tecumseh	Johnson	W. L. Dunlap.
Tekamah	Burt	Dr. A. D. Nesbit.
Thedford	Thomas	C. C. Wright.
Valentine	Cherry	Observer Signal Service.
Wallace	Lincoln	W. Bardon.
Weeping Water	Cass	G. Treat.
West Hill	Platte	J. L. Truman.
West Point	Cuming	E. G. Bruner.
Weston	Saunders	J. R. Campbell.
Whitman	Grant	T. Donegan.
Wilcox	Kearney	Mrs. C. W. Le Bar.
Yankton, S. Dakota		Observer Signal Service.
York	York	W. H. Davis.

REVIEW OF THE WEATHER FOR THE YEAR.

JANUARY.

January opened and closed with mild and pleasant weather; cold weather prevailed from about the 12th to the 24th, beginning with a considerable snow storm generally throughout the state from the 10th to the 12th, accompanied by high winds; there were slight snow storms also about the 4th and 22d. The mean temperature has been about normal, but with extremes both of heat and cold; the storm about the 11th was accompanied by high winds.

Temperature.

The mean temperature for southeastern Nebraska was 17.6°; in the northern part of the state considerable cold weather occurred, reaching a minimum of 34° below zero at Fort Niobrara; the maximum of the month was 72° at Mullen, which is higher than heretofore reported for January, except in 1888.

Precipitation.

A map of precipitation for the month shows a small area in the extreme southeastern part of the state with over two inches; the east central part of the state generally from one to two, and the remainder of the state, with a small area in

Saunders and adjacent counties, less than an inch. There have been more than the normal number of cloudy days and of days in which some snow fell.

Notes From Observers.

"The winter has been quite cold, the first twenty days averaging only 8°, the latter part being much warmer. On the 12th we had a blizzard, though not nearly as severe as the one on January 12, 1888." E. F. Erwin, Craig.

"Moderate and comfortable weather from the 1st to the 12th, then cold up to the 24th, then moderate, comfortable and spring-like the rest of the month." G. Treat, Weeping Water.

"The winter so far has been the mildest I remember; only two weeks that appeared like winter. Stock are going through in fine condition." Dr. Humphrey, Fairbury.

FEBRUARY.

The month of February was generally warm, with considerable extremes of temperature. It was more than usually cloudy, but with little rain or snow.

Temperature.

The mean temperature for southwestern Nebraska was 26.5°, which is about 3° above the normal; it reached a maximum of 74° in the southern part of the state and a minimum of 29° below zero in the northern part during the month which is both higher and lower than our records show in any preceding February.

Precipitation.

Only one station, Valentine, reported over an inch of precipitation; a strip extending through the northern and northeastern part of the state had over half an inch, while along the southern border there was generally but a trace. The precipitation came almost wholly in the early and the latter part of the month, from the 9th to the 10th and from the 22d to the 27th, which latter storm was followed by the cold wave which gave the minimum temperature of the month.

Notes From Observers.

"Wild geese were seen going north on the 2d and 4th, blue birds on the 5th, and robins on the 9th. Weather decidedly variable." W. L. Dunlap, Tecumseh.

"February has been a pleasant month though generally cold. The first half was warm and the last half quite cold, getting as low as 21° below zero on the 27th. Very light precipitation." E. F. Irwin, Craig.

"During February the first week was the warmest of the four, while the last week produced some of the coldest and severest weather of this winter." G. S. Clingman, Oakdale.

"Weather more severe than the cold weather of last month on account of frequent high winds." E. W. Black, North Loup.

"The first half of the month was warm and frost out of the ground, so there was considerable plowing done and some wheat sown." Wm. Waterman, Hay Springs.

"Range of temperature during the month 25°, which is excessive even for this changeable climate." S. W. Reynolds, Fort Robinson.

MARCH.

The month of March was cold and backward, with less than usual rain but more than usual rainy days.

Temperature.

The mean temperature for the month was 33.7°, which is about 3° below the normal; the maximum for the month, 75°, is about the usual maximum, and the minimum, 7° below zero, rather lower than usual in March, although in 1886 it went down to 15° below.

Precipitation.

With the exception of a narrow strip along the northern border of the state and a wider one along the northeastern, the precipitation amounted to less than an inch; in the extreme northeast and at Valentine it amounted to over two inches. The mean for the state was about an inch. The number of rainy days was slightly greater than the normal.

Notes From Observers.

"March has been rough and cold. Farmers have not as yet been able to plow or sow. Winter wheat does not promise well, but recent rains may bring it out all right. Robins, bluebirds, and tomtits remained here all winter." W. L. Dunlap, Tecumseh.

"Weather for March has been cold and windy. The mean temperature is lower than for the past two years. Farmers sowing wheat and oats." G. D. Carrington, Howe.

"Robins singing on the 18th; bluebirds seen on the 16th; elm and maple buds swelling on the 23d." G. Treat, Weeping Water.

"March has been a pleasant month; not much cold weather. But very little work has been done on the farms this month." A. D. Nesbit, Tekamah.

"The first thunder of the season was heard on the morning of the 27th." E. G. Bruner, West Point.

"Larks and prairie chickens were first seen on the 17th." John Ellis, Marquette.

"Seeding has begun, with indications of a larger acreage of small grain than for several years. First appearance of larks on 20th, and first thunder and lightning on the 17th." J. L. Truman, West Hill.

"Weather cool and spring backward. Some seeding done and much frost in the ground." T. A. Watson, Grand Island.

"This month was very unfavorable for agriculture. Not much grain was put in, the ground often being frozen." C. Shieldstream, Palmer.

"The month very dry, seeding backward; commenced plowing 16th and sowing wheat 20th; saw first lark on the 19th, first kildeer on the 22d, first kingfisher on the 26th; saw first lightning on the 21st and first thunder storm here on the 27th." J. S. Spooner, Sargent.

"March has been colder than usual and we have had considerable snow." L. S. Trefun, Mullen.

"Last half of the month very windy. First meadow lark seen on the 27th." Wm. Waterman, Hay Springs.

APRIL.

The month of April was decidedly warm and dry; the mean temperature was 4° above the normal and the precipitation only about half the usual amount.

Temperature.

The monthly range of temperature for the state was 87°, from a maximum of 94° at Wilcox to a minimum of 7° at Fort Niobrara. The April temperature has not ranged lower since 1881, nor higher since 1883. The mean temperature for southeastern Nebraska was 55.3°, which has been exceeded only once—in 1883.

Precipitation.

The region of the greatest rainfall was the extreme southwestern corner of the state, and next to this the southeastern. A narrow strip along the lower Platte and thence south to Franklin received less than an inch; the mean for the state was two inches. A considerable fall of snow occurred in the northern part of the state.

Notes From Observers.

"Since my last report the winter wheat has developed grandly and can now be safely rated at 96 per cent. Pasturage is short for want of rain. Farmers are well ahead with their work." W. L. Dunlap, Tecumseh.

"Farmers planting corn; wheat and oats not doing well on account of drought." G. D. Carrington, Howe.

"The month has been pleasant but came short of the usual April showers, and rain is needed very much. Trees of all kinds in full blossom and the prospect is very good for fruit." P. W. Risser, Syracuse.

"Ground quite dry; unless rain comes soon small grain will suffer somewhat. Farmers preparing for corn and some are planting." G. Treat, Weeping Water.

"The ground is very dry. Farmers are preparing for corn and some have already planted. The fruit trees are in blossom and give promise of an abundance of fruit." Dr Nesbit, Tekamah.

"The ground is very dry; for two to four feet deep it appears almost perfectly dry." I. E. Heaton, Fremont.

"Spring has opened finely; fruit is in abundant blossom, but we greatly need rain." Geo. Shedd, Ashland.

"Dry; fruit trees of all kinds blossoming very heavily; corn planting begun." E. B. Taylor, David City.

"Small grain looking fair on old ground; stock generally looking well; some corn planted, but ground very dry." T. A. Watson, Grand Island.

"An unusually warm spring, but vegetation is not correspondingly advanced. Precipitation about normal. Small grain was put in under favorable conditions and looks well." J. S. Spooner, Sargent.

"Month closes warm and pleasant; plenty of rain and pasturage good. Wheat and oats fine, with a large acreage sown. Plowing for corn well advanced and a large proportion planted." Mrs. L. A. Wibley, Culbertson.

"High wind began on the 7th and continued about forty hours, during which our heaviest snow of the month fell; snow flying on one side of the road and dust on the other." S. W. Reynolds, Fort Robinson.

MAY.

The month of May shows an exceedingly wide range of temperature, but a mean temperature very nearly normal. It was a month very deficient in rainfall, especially in the western and southwestern parts of the state.

Temperature.

The temperature ranged from a minimum of 14° to a maximum of 100, neither of which has been exceeded in previous years. The mean temperature was 61.

Precipitation.

Tha regions of greatest rainfall were along the Missouri and Elkhorn rivers, reaching a maximum of 6.75 inches at West Point. The Loup river basin was also fairly well watered; from there south and westward the amount falls off, reaching a minimum of 0.56 at Culbertson.

Notes From Observers.

"The corn that was retarded by cool nights is now rapidly pushing up. All crops are doing well." G. D. Carrington, Howe.

"The frost of the 7th killed tomatoes and other tender plants. Much more rain needed." W. L. Dunlap, Tecumseh.

"The first of the month was cool and dry, too much so for all crops to do well, but the latter part was warmer, and the frequent rains helped vegetation wonderfully and the prospect for everything is now very good." P. W. Risser, Syracuse.

"The ground is in fine condition for crops." G. Treat, Weeping Water.

"The mean for the past month has been just the same as that for May, 1889, but the extremes were not as great. A heavy frost occurred on the 7th, doing slight damage to fruit. The precipitation has been about normal, being an even three inches for the month, which has fallen in frequent showers and kept crops in good condition." G. S. Clingman, Oakdale.

"The frost on the 6th and 7th cut down early potatoes and the leaves and buds on several kinds of trees." G. S. Truman, Genoa.

"First thunder this year on the 11th. Rain from a clear sky, with a brilliant rainbow, at 6:45 P. M. on the 17th." E. Smith, Ravenna.

"We are below normal in rainfall, and all small grain is injured. Had a destructive hail storm on the 18th, damaging everything in its path, which was one and a half by three miles." Dr. Humphrey, Fairbury.

"Wheat and oats have been injured by the dry weather. Pastures are short and hay will be light. Corn is looking well." Dr. C. M. Eaton, Hebron.

"Crops are doing as well as could be expected in the face of cool, dry weather." T. A. Watson, Grand Island.

"Month cold, raw, and backward, with an excessive amount of high wind and no rain of consequence. Corn at present writing is but up and not as forward as it should be. Small grain satisfactory." A. H. Gale, Bassett.

"May 30. Temperature of the soil eight feet deep, 70°; eighty feet deep in well, 54°. Corn now has fourth leaf." R. W. Blake, Long Pine.

"Month closes very dry; no rain to speak of; large portion of spring wheat being plowed up. Corn on old ground not suffering; very little sod corn coming up." Mrs. L. A. Wibley, Culbertson.

"Vegetation is reported as very backward in this section." S. W. Reynolds, Fort Robinson.

JUNE.

The month of June was one of extremes of temperature and of precipitation, the maximum temperature for the month being the highest yet recorded for June and the minimum the lowest, and the rainfall varying from less than an inch in the west to over eighteen inches in the east.

Temperature.

The temperature for the month ranged from a minimum of 32° at Alliance to a maximum of 108° at Ansley and Thedford. A slight frost was reported in connection with this minimum but no damage done. The mean temperature was 75.2°, or about 5° above the normal.

Precipitation.

All the stations in the extreme western part of the state report less than an inch of rainfall. From there eastward the amount increases quite irregularly to the Missouri river; the greater part of the state received three or four inches, although a limited region on the upper Niobrara received about six inches. The region of greatest rainfall is an area stretching east from Tekamah, where 18.70 inches was reported, into Fayette county, Iowa, where 16.53 inches was reported by the Iowa Weather Service. The largest monthly rainfall previously reported in Nebraska was 18.02, at Plattsmouth in June, 1874.

Tornadoes.

Two tornadoes have devastated towns in Nebraska during the past month; one on the 3d, passing through the northwestern part of York county, almost completely destroyed the town of Bradshaw; another on the 22d, in northwestern Buffalo county, completely destroyed the half dozen buildings of the little town of Sweetwater.

Notes From Observers.

"Too little rainfall; small grain short, but fairly headed; corn well cultivated and looked well at end of month; blackberries and raspberries dried up on the vines; grapes were mostly killed by the frost of May 7, but the vines blossomed again and many more clusters set than before, and they now promise well." W. L. Dunlap, Tecumseh.

"The weather had been very favorable for all kinds of products up to the 20th, when the hot weather set in and, continuing to the 28th, almost melted everything; but a good rain on the latter day changed things for the better." P. W. Risser, Syracuse.

"The latter half of the month extremely hot, but excellent corn weather. Small grain improved very much. Apples have thinned out considerably but leaving room for the rest to grow larger." G. Treat, Weeping Water.

"In our neighborhood all crops look well. Apple trees badly blighted; they had this spring such a profusion of blossoms that some trees were killed, especially Emperor of Alexander; small fruit, cherries and plums are plenty." Chas Seltz, De Soto.

"The wind did some damage here on the 22d, but not worthy the name of tornado." I. E. Heaton, Fremont.

"Tornado at Sweetwater on the 22d." E. Smith, Ravenna.

"Hail on the 2d and 3d did a great deal of damage in kitchen gardens and nearly ruined some fields of corn" Mrs. M. G. Erickson, Kennedy.

"Small grain has been badly damaged by dry weather and by hot south winds; will average about half a crop. Corn at present promises a good yield." J. M. Tipton, Lexington.

"Corn in fine condition; wheat good in some fields, but the larger portion is a failure. Hot winds for days together scorched vegetation badly." Mrs. L. A. Wibley, Culbertson.

"Frost on the 7th in a few places; no damage." Wm. Waterman, Hay Springs.

JULY.

The month of July was extremely dry and hot, and there is an almost universal complaint of the failure of the crops.

Temperature.

The month was, on the whole, the hottest on record; the mean temperature, 77.8°, was about equaled in July, 1888, but has not been exceeded; the maximum, 112°, as recorded at Wilcox and at Thedford, is 1° above that of July, 1889, and 7° higher than any previously recorded.

Precipitation.

There was a fair amount of rain in the northern and southeastern parts of the state, but elsewhere a deficiency, and in the southwestern part of the state, where the drought in June was severe, there was only a fraction of an inch. There was also a marked preponderance of clear skies and much hot wind.

Notes From Observers.

"Winter wheat of good quality, yield eight to thirty-two bushels; corn looks remarkably well considering the weather." W. L. Dunlap, Tecumseh.

"The month has been exceedingly hot and dry, yet the corn crop looks fair and, with another rain or two, will secure a good half crop." P. W. Risser, Syracuse.

"Corn is fairly good. Small grain mostly secured in good shape." G. Treat, Weeping Water.

"The rainfall of the past month has been quite fair in amount, but not well distributed as to time, and many fields of corn are now suffering for want of it." Geo. Shedd, Ashland.

"Oats average about thirty bushels per acre, against forty last year, but quality better." Chas. Seltz, De Soto.

"The rainfall has been light this month, yet sufficient to insure a good corn crop. The potato crop is light, due to drought the first of the month and extreme wet in June." A. D. Nesbit, Tekamah.

"On the 29th the grass was so dry that lightning from a small cloud (no rain) set it on fire a few miles from town and about 100 acres were burned over." G. S. Clingman, Oakdale.

"On July 5th the temperature of the soil eight inches deep was 98° at 4 P. M." R. W. Blake, Long Pine.

"The month has been remarkable for its intense heat, made more so by high southerly winds, which have nearly if not quite ruined the growing corn, baking the ground so that what little rain we have had was absorbed before reaching the

plant roots; with copious rain we cannot expect more than half a crop." Geo. S. Truman, Genoa.

"The past month has been very warm and dry. Corn will not make one-fourth crop. Oats and hay will be about half a crop. Pastures pretty well dried up. Sugar beets standing the drought in good shape." T. A. Watson, Grand Island.

"We have had no general rain in this section during the month of July. The hot dry winds have damaged the corn crop very much." Peter Fowlie, Ansley.

"Wheat, so far as threshing has been done, averages from seven to ten bushels per acre. The dry weather and the hot winds have almost totally destroyed the corn crop." J. M. Tipton, Lexington.

"Very hot and dry. Small grain hardly paid for harvesting and corn is thought to be ruined by the dry weather and hot wind." Mrs. C. W. Le Bar, Wilcox.

"This has been the hottest July ever known here. High hot winds blew for twelve days. Corn is nearly all burned up and is being cut for fuel. Wheat and oats in most cases did not pay for seed corn; no potatoes." Mrs. L. A. Wibley, Culbertson.

AUGUST.

The month has been one of extremes of temperature, with an average a little below the normal; the rainfall, although less than normal for southeastern Nebraska, was, on the whole, sufficient to improve greatly the condition of the crops.

Temperature.

A maximum temperature of 108° occurred at several stations early in the month which is in excess of any preceding August; a minimum of 34° is lower than any, except August, 1888, which gave the same temperature. The mean for the month, 72.2°, was about a degree below normal.

Precipitation.

Rainfall was quite evenly distributed over the state; three isolated localities in the northeastern, southwestern, and middle parts of the state received less than an inch, and one in the southeastern as high as five inches, but over the greater part of the state from one to three inches fell. There was a larger than the normal amount of cloudiness.

Notes From Observers.

"Corn promises from twenty to forty bushels; potatoes are almost a total failure; grass very short; green worms are eating the cabbage; turnips fair, and an immense crop of the finest watermelons." W. L. Dunlap, Tecumseh.

"The fine rains we had during the month helped the corn crop a great deal, prepared the ground nicely for fall plowing, and the amount of good it has done to pastures is hard to estimate; apples and grapes are much better than we looked for." P. W. Risser, Syracuse.

"The corn crop is coming on finely; some pieces will yield as much as usual. Small grain is of good quality, but perhaps not quite so heavy as last year." G. Treat, Weeping Water.

"Brilliant meteor in western sky at 8 P. M., the 8th." E. B. Taylor, David City.

"Beautiful, fair weather, but rather dry for fall plowing. Corn will average a fair crop; hay, while not heavy, will make a fair crop." R. W. Blake, Long Pine.

"There is a fine crop of hay. Corn is filling out and ripening well; with the exception of potatoes, vegetables have done finely." Mrs. M. G. Erickson, Kennedy.

"The rain this month has improved the prospects of the corn that was planted late, and helped the hay crop considerably, making an abundance of grass on the pasture land." Peter Fowlie, Ansley.

"The continued high temperature and small amount of precipitation has kept corn to a low condition, and it now seems that not more than half an average crop can be expected, and many experienced farmers place it at less. Hay is a third and potatoes are a fourth of an average crop. Wheat is threshing out better than it appeared at harvesting. This county (Kearney) will come out: wheat, eighty per cent, oats forty-five, barley thirty-five of an average crop, with quality better than average." J. Hull, Minden.

"Many farmers not having any old corn left over, and this year's crop being ruined, are compelled to feed their horses wheat." J. M. Tipton, Lexington.

"Corn will make a fair crop for this county (Sheridan)." Wm. Waterman, Hay Springs.

SEPTEMBER.

The month was one of extremes in temperature, early frost and prevailing lack of rain, with considerable cloudiness.

Temperature.

The mean temperature for the month, 62.4, was about 2° below the normal. A maximum temperature of 104°, excessive for September, was reached at Wilcox, and a minimum of 18°, also unusual for September, was reached at Fort Niobrara in connection with the first heavy frost of the season on the 13th.

Precipitation.

Over the western half of the state the rainfall varied from none or a mere trace in the extreme west, to one inch through the middle and northeast; over the remainder of the state from one to three inches fell.

Notes From Observers.

"Comparatively dry, but crops are safe now and quite plenty to spare for export." G. Treat, Weeping Water.

"This September is remarkable for the unusual number of frosts, yet doing no material damage. The area of winter wheat sown is at least 400 per cent greater than last year and promises all that could be desired." W. L. Dunlap, Tecumseh.

"Corn almost as good as last year; potatoes rather poor; gardens good." E. G. Bruner, West Point.

"The first killing frost of the season was on the 13th, when ice was one-fourth of an inch thick." G. S. Truman, Genoa.

"Ground very dry; four frosts noticed this month." T. A. Watson, Grand Island.

"Ground very dry; winter wheat shows fairly well, but has not all come up. Corn more nearly a failure than was supposed, much of it being green when the frost came and is soft, and some almost worthless except as fodder." P. B. Gaylord, Fairfield.

"The precipitation has been far below the average, and a September frost before the middle of the month has heretofore been almost unknown." Dr. C. M. Easton, Hebron.

"Least rainfall so far this year of any during past thirteen years. Corn husking out far less than appeared to promise a month ago, averaging but about eleven bushels in this (Kearney) county. Plenty of feed secured. Too dry to do fall plowing, and pastures drying up." Joel Hull, Minden.

"Light frosts on the 6th and 7th, doing no damage; but a severe freeze on the 13th practically stopped all corn growing in this vicinity. Corn is a failure, wheat stands about seventy-five per cent, oats twenty-five, rye twenty, flax twenty, potatoes thirty, and wild hay fifty. The farmers are relieving themselves of stock, hogs, and cattle, as grain, and even rough feed, is very scarce." J. S. Spooner, Sargent.

"Ground very dry and rains are needed for fall wheat and rye. The freeze on the 12th will make much soft corn." A. H. Gale, Bassett.

"The month has been very windy, changeable, and dry." Mrs. M. G. Erickson, Kennedy.

OCTOBER.

The month of October was one of nearly normal precipitation and temperature, although with a large range in the latter.

Temperature.

The highest temperature reported for the month was 92°, which is very unusual for October; the lowest 8°, which has not been exceeded since 1887. The mean temperature for southeastern Nebraska was 52°, which is almost exactly the normal temperature.

Precipitation.

A map of precipitation for the month shows the west half of the state with less than an inch of rainfall; the east half more than an inch, with a maximum of 3.28 at Superior and another high area stretching from the middle of the state to the northeastern corner. The number of rainy days and the amount of cloudiness were about normal.

Notes From Observers.

"October has been a pleasant month; farmers are busy picking corn, which is an average crop in this county." A. D. Nesbit, Tekamah.

"The month has been a fine one; a large amount of winter wheat sown and is looking well." R. B. Spear, Geneva.

"Farmers inproving the time gathering corn and apples; corn yielding from twenty to forty, average about thirty bushels per acre." G. D. Carrington, Howe.

"The month has been all we could ask in the way of fine weather, drying corn in nice shape for gathering." Dr. I. Humphrey, Fairbury.

"The month has been so dry throughout that no fall plowing has been done. Corn husking rapidly progressing, coming in in excellent condition; quality number three and four. Pasture injured more by drouth than frost; fattening hogs and cattle marketed just as soon as ready. Corn will not average more than eleven bushels per acre, probably about ten." J. Hull, Minden.

"Warm wind from northwest on the evening of the 26th and on the following day." E. W. Black, North Loup.

"The month has been very dry, with very high winds during the middle of the day." Wm. Waterman, Hay Springs.

NOVEMBER.

The month of November was warm and dry, with prevailing clear skies and almost no snow. The ground as yet is not frozen so as to prevent fall plowing.

Temperature.

The mean temperature for the month was the highest on record for November, 41.2°, for southeastern Nebraska. The extremes have not been great, ranging from 8 below to 79 above.

Precipitation.

The southeastern part of the state had a little more than its average rainfall, ranging from one to two inches; throughout the remainder of the state the precipitation was less than an inch and generally less than half an inch.

Notes From Observers.

"November has been a warm, dry month, with less than an inch of rainfall. Corn is about all in the cribs, averaging thirty bushels per acre." G. D. Carrington, Howe.

"Weather fine for the season; stock doing finely; winter wheat still in first rate condition; corn was a better yield than could have been expected considering the severe drouth of last season; very little selling, brings 45 cents. The outlook for next year's crop is far from encouraging." W. L. Dunlap, Tecumseh.

"Many clear days during the month. Glowing sunsets are noticed again of late." G. Treat, Weeping Water.

"November has been a very pleasant month; ground dry but not frozen." A. D. Nesbit, Tekamah.

"Warm month; the largest amount of winter wheat sown I ever saw, and all looking finely; corn all gathered and about ten bushels per acre on an average through the county." R. B. Spear, Geneva.

"The extremes of temperature have not been so marked as in the preceding years, and the mean temperature has been the highest since we have kept the record, five years." Dr. C. M. Easton, Hebron.

"This month the ground has been in good condition for fall plowing, which has been practically completed in good shape." E. Smith, Ravenna.

"The month has been noticeable for still, warm, sunshiny days. Ground goes into winter very dry. Tree claims may suffer if remainder of winter sets in and holds severe." A. H. Gale, Bassett.

"We have had an exceptionally warm and pleasant month, and range cattle were never looking finer." Mrs. M. G. Erickson, Kennedy.

"Month has been warm and pleasant, with more than the usual number of clear days." Wm. Waterman, Hay Springs.

DECEMBER.

The month was one of the warmest and driest of Decembers, although not as warm as last December; the ground was scarcely frozen so as to prevent plowing. There was a conspicuous absence of storms.

Temperature.

The mean for southeastern Nebraska was 32.5°, exceeded only in 1881 and 1889. There were more than the normal number of days below 32°, but in southeastern Nebraska it did not fall below zero, and in the northern part of the state only to 10° below.

Precipitation.

Throughout the central part of the state there was no precipitation, or only a trace, and throughout the state it did not exceed half an inch, except at Kimball and Franklin. There were much more than the normal number of clear days.

Notes From Observers.

"December has been unusually dry and warm, with considerable light wind." A. D. Nesbit, Tekamah.

"This month was unusually fine; ground remained unfrozen so as to allow grading the entire month." E. G. Bruner, West Point.

"Fair, sunshiny weather, with only four cloudy days. Temperature at no time down to zero. The ground frozen about three inches and very dry; many wells drying and some dried out; the surface is still moist enough in the fields." G. Treat, Weeping Water.

"This December is remarkable for its fine weather; stock of all kinds in good condition." W. L. Dunlap, Tecumseh.

"Most remarkable weather during December for the past twenty years; no precipitation, with clear days and nights; winds light, except one or two wind and dust storms of short duration. Fall wheat doing well so far. Mild temperature with a lower mean than last year, but no zero weather. No fowl flying of any note." G. D. Carrington, Howe.

"Month of December finest I ever saw; ground not frozen on the 31st." R. B. Spear, Geneva.

"Weather fine during most of the month; ground dry but not frozen to any extent. Stock doing well; corn turned out better than was expected considering the long drouth." S. C. Woodruff, Stromsburg.

"Remarkable calm and pleasant month; ground up to 31st not frozen; exceptional weather for the month." A. H. Gale, Bassett.

"Month of December temperate and dry; cottonwood buds swelling." John Ellis, Marquette.

"December has been an unusually warm month, with no precipitation whatever. Winds have been unusually severe, almost a hurricane on the 26th. The year went out in a terrific gale. Distant thunder was heard in the northwest on the 23d." J. S. Spooner, Sargent.

"Stock is doing well up to date on stalks and the pastures, with a good prospect of getting through the winter with the supply of feed on hand. Considerable fall plowing has been done, perhaps one-third of usual amount." Joel Hull, Minden.

"The temperature has been nearly the same throughout the month, except on the 7th, when it was 2° below zero, and on the 25th, when it was only 4° above, but the cold only lasted a few hours each time." Mrs. M. E. Randolph, Holdrege.

"The weather has been lovely, almost an unbroken series of beautiful, clear, mild days. This has made it exceedingly favorable for the hundreds of poor families in the west section of the state." J. M. Tipton, Lexington.

"The temperature has not been down to zero yet this season." Wm. Waterman, Hay Springs.

THE YEAR AS A WHOLE.

The year of 1890 has been the driest of the thirteen years covered by our records, and the hottest, with the exception of 1878, the first of these thirteen years.

The mean temperature of southeastern Nebraska for the year was 50.7°, which is 1.6° above the normal. Twice during the thirteen years the mean temperature has been up to 50.6°, viz., in 1882 and in 1889; the mean for 1878 was 51.4°.

The year has been one of extremes of temperature; the highest for the year was 112°, which has not been exceeded and only once nearly equaled, viz., in 1889, which gave a maximum of 111; the lowest was 34° below zero, which was only exceeded by one degree in 1888. The total amount of freezing weather however has been about normal.

The facts regarding the amount of rainfall and its distribution over the state are best presented in the maps at the end of this report. By these it will be seen that the rainfall nowhere amounted to twenty-five inches, and over nearly half the state did not reach fifteen. Two localities especially suffered, viz., a region in and around Hamilton county and a more extended area throughout the western and southwestern parts of the state, continued as a narrow strip eastward along the north side of Pine Ridge. The amount of rainfall increases, in the main, as we go eastward and reaches its highest in two localities along the Missouri river.

As the success of crops depends not so much upon the total amount of rain for the year as upon that which falls in the growing season, another map has been prepared to show the distribution of the rainfall of these growing months; this critical period is taken to cover the months of April to August inclusive. It will be seen that this map bears a close resemblance to that of the rainfall for the year, showing the same two localities of especial drought and the same two of more abundant rainfall.

For the purpose of showing how much our rainfall for the past season has fallen below the usual amount, a third map has been prepared, showing the normal rainfall for the same growing season. This map, it should be said, is only approximately correct, but sufficiently so to make the comparison of the past year with the average years an instructive one. The data for this map of normal rainfall are derived from the "Climate of Nebraska," published by the United States senate, May, 1890, from compilations by the Chief Signal Officer. It does not include all the data, especially for early years, which are on file in this office; and when all these data can be included and reduced we shall be able to derive from them a more exact map of the normal distribution of rainfall in the state. It should be noticed also in comparing the map of precipitation for the growing season of 1890 with the map of normal precipitation that the various amounts of rainfall are represented by different shades in the two maps. The last map shows the number of rainy days during the year in various parts of the state; as in the case of the amount of rainfall, a maximum is reached along the Missouri river, and two regions of deficiency are found, one southeast of the center and one in the southwestern part of the state.

In comparing the rainfall for 1890 with that of previous years we find that in southeastern Nebraska the smallest rainfall previously recorded is 22.95 inches, in 1887, and the average for thirteen years is 28.61 inches. The rainfall for 1890 was only 21.81 inches, almost seven inches below the normal.

The number of rainy days is not so deficient. The least number for any year

thus far was fifty-three days in 1878 and 1880; the number for 1890 was sixty, and the average number for the past thirteen years is seventy-one.

Cloudy days have even been in excess of the normal number, but so have the clear days, so that the year as a whole has been one of fair rather than of clear days.

The fall of snow was 19.5 inches, which is five inches below the normal; there have, however, been six years in which the snowfall was less than in 1890, and only six in which it was greater.

COMPARISON OF THE YEAR 1890 WITH PREVIOUS YEARS.

Owing to the meagerness of the records of early years for the western part of the state, it has not seemed wise to attempt any detailed comparison of the weather of the state as a whole for different years.

For the older part of the state, however, we have copious records running back to 1878. The "whole state," as it was called in the bulletins of the Nebraska Weather Service up to and including 1885, contained but few stations outside of the limits of what has since been called the "southeastern section" of the state. An instructive comparison is therefore possible of the weather for different years in southeastern Nebraska. The comparison would probably not be very different for the state as a whole.

The following tables show accordingly the mean temperature, the number of days in which the thermometer rose above 85° or fell below the freezing point and below zero, the amount of precipitation and the number of days on which it fell, the number of cloudy days and of clear days, and the depth of snowfall for southeastern Nebraska; these items are found by averaging the number reported at the different stations. Days are counted cloudy when the sky is four-fifths overcast, clear when less than one-third. The tables also show the highest temperature, and the lowest recorded anywhere in the state by standard self-registering thermometers. Numbers enclosed in brackets are assumed for the purpose of making averages, the amounts assumed being derived from reports of other years in the same section:

JANUARY.

	Mean temperature.	Below 32°.	Below zero.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.	Snow.
1878	26.9	15.0	....	....	....	0.86	2.0	4.0	18.0	[4.9]
1879	18.5	30.5	10.1	....	....	0.66	2.1	3.8	17.4	3.1
1880	33.4	28.8	0.0	....	....	0.54	1.8	3.8	16.9	2.6
1881	12.8	30.4	10.7	42	-32	1.31	5.6	6.1	10.9	6.6
1882	24.5	28.2	1.7	50	- 1	0.96	8.9	6.2	12.8	3.5
1883	11.8	27.3	7.8	50	-28	1.09	6.7	4.3	11.7	9.7
1884	17.2	[27.3]	[7.8]	49	-32	0.68	[3.8]	[4.8]	[14.4]	[4.9]
1885	12.3	[31.0]	[16.2]	57	-27	1.57	4.5	5.5	13.0	3.7
1886	6.8	30.3	11.4	52	-25	2.04	9.1	9.5	9.9	18.8
1887	18.1	31.0	13.0	60	-30	0.46	4.7	6.0	13.8	5.4
1888	10.2	31.0	15.4	72	-35	0.64	2.7	4.0	13.0	3.8
1889	23.5	30.0	1.0	58	-16	1.35	4.3	7.7	15.7	4.3
1890	17.6	28.0	9.6	72	-34	1.24	5.6	8.6	13.4	7.7
Mean....	17.5	28.3	8.2	....	....	0.92	4.3	5.9	13.9	6.1

FEBRUARY.

	Mean temperature.	Below 32°.	Below zero.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.	Snow.
1878	35.6	....	....	....	....	0.19	1.2	5.7	11.0	0.9
1879	19.6	....	....	....	....	0.76	8.2	2.7	8.5	[6.8]
1880	30.1	26.0	1.2	....	....	0.14	1.6	0.9	18.1	0.8
1881	18.2	25.4	5.5	40	-23	2.72	5.2	7.0	10.2	14.4
1882	33.4	23.0	0.7	64	- 8	0.82	2.9	4.0	17.8	6.4
1883	20.5	24.2	5.6	61	-25	0.90	5.2	6.2	13.4	4.9
1884	18.5	27.3	9.0	57	-20	0.78	5.2	7.2	8.9	7.1
1885	15.9	22.6	10.9	57	-22	1.12	6.0	7.6	11.2	9.3
1886	25.8	25.6	3.8	64	-19	0.70	4.2	3.8	16.1	5.5
1887	19.0	27.7	7.8	64	-24	1.06	6.4	9.8	12.0	8.4
1888	27.7	23.0	15.4	68	-19	0.91	4.8	5.0	6.0	2.8
1889	22.8	23.3	4.2	66	-27	0.35	8.5	5.4	8.9	2.3
1890	26 5	25.8	4.1	74	-29	0.35	8.4	10.6	9.0	2.9
Mean....	24.2	24.8	6.1	....	....	0.84	4.0	5.8	11.6	5.4

MARCH.

	Mean temperature.	Below 32°.	Below zero.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.	Snow.
1878	46.8	9.8	....	80	22	1.64	4.3	5.4	13.8	3.8
1879	40.6	....	....	86	1	0.63	8.5	2.3	14.2	3.6
1880	34.8	22.2	1.8	....	....	0.49	2.6	2.2	16.3	4.7
1881	29.2	28.4	0.0	51	4	1.77	6.0	6.6	12.6	12.1
1882	40.2	16.4	0.0	77	4	0.26	2.3	2.6	15.8	3.0
1883	33.6	26.3	0.1	71	3	0.59	4.6	9.7	11.8	5.2
1884	34.8	17.4	1.4	73	- 5	2.36	8.7	10.6	7.0	2.4
1885	35.7	26.2	0.0	70	7	0.28	8.1	2.6	17.5	2.2
1886	31.7	24.8	1.6	73	-15	2.75	8.5	11.9	9.6	25.3
1887	37.7	21.9	0.0	80	- 6	0.36	8.4	5.6	12.6	3.4
1888	29.5	24.0	1.2	80	-15	3.51	7.0	9.5	9.0	4.5
1889	42.1	16.5	0.0	76	4	1.37	3.3	6.3	12.7	1.0
1890	33.7	25.0	0.0	75	- 7	0.89	5.0	10.0	11.0	8.9
Mean....	36.2	21.5	0.5	....	....	1.30	4.8	6.5	12.6	6.2

APRIL.

	Mean temperature.	Below 32°.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.
1878	53.0	4.4	82	34	2.42	6.2	6.4	15.2
1879	52.0	5.5	80	13	3.11	7.4	5.4	12.6
1880	51.3	5.2	91	20	0.82	2.3	2.6	17.0
1881	45.1	9.8	81	6	2.91	7.4	6.8	9.1
1882	51.4	3.9	87	25	4.80	7.3	9.2	8.7
1883	52.3	3.2	95	29	2.43	8.0	5.2	9.6
1884	49.4	10.2	81	22	2.91	7.4	10.0	7.5
1885	49.2	4.8	84	20	4.29	10.1	7.8	9.0
1886	50.4	6.7	85	16	2.78	9.7	7.7	9.7
1887	53.5	5.6	93	14	1.62	7.5	5.8	11.6
1888	56.6	1.3	89	21	2.57	6.1	6.2	10.8
1889	52.3	1.0	87	13	2.50	7.8	9.4	12.8
1890	55.3	1.0	94	7	1.12	3.9	9.8	18.0
Mean	51.7	4.9	....	....	2.68	7.0	7.1	11.3

MAY.

	Mean temperature.	Below 32°.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.
1878	55.8	2.7	....	....	4.48	8.6	7.9	11.6
1879	64.8	1.6	91	32	4.02	7.5	4.4	11.8
1880	67.2	0.4	94	37	2.62	5.2	3.6	14.5
1881	67.2	0.0	90	44	6.94	10.5	7.5	4.6
1882	56.4	2.1	89	35	4.44	11.2	11.5	5.8
1883	58.5	1.4	93	35	5.65	11.7	8 6	7.0
1884	59.8	0.4	88	32	2.76	7.3	6.5	11.2
1885	58.3	4.2	86	29	4.11	8.2	6.0	13.7
1886	65.0	0.8	93	25	4.55	11.0	3.8	14.1
1887	65.2	3.0	94	22	3.04	7.3	3.6	17.4
1888	57.4	0.2	82	27	5.74	10.9	10.6	11.3
1889	62.1	0.1	95	22	4.36	9.3	8.8	11.3
1890	61.0	1.0	100	14	3.00	8.9	7.4	13.4
Mean	61.4	3.9	....	....	4.25	9.0	6.9	11.3

JUNE.

	Mean temperature.	Above 85°.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.
1878	66.7	8.5	....	....	5.98	8.2	4.0	12.7
1879	69.9	11.4	92	49	4.94	8.2	3.1	14.1
1880	73.4	11.6	97	46	5.27	7.1	3.6	12.9
1881	74.1	12.4	95	58	5.18	8.1	1.6	12.3
1882	72.2	11.4	93	46	5.24	10.5	5.8	8.6
1883	69.4	3.6	96	42	9.44	11.2	3.7	13.0
1884	71.9	14.2	94	45	2.48	5.9	2.7	11.3
1885	65.8	9.0	94	43	2.77	8.0	4.2	13.4
1886	70.0	8.7	92	38	4.22	8.9	1.9	15.0
1887	72.6	10.3	94	39	4.24	8.6	3.3	8.0
1888	69.4	8.0	102	37	4.32	7.8	4.0	7.3
1889	69.0	8.7	104	37	3.78	9.5	6.1	12.6
1890	75.2	16.2	108	32	4.27	8.1	5.3	14.0
Mean	70.8	10.3	....	....	4.76	8.5	4.2	11.9

JULY.

	Mean temperature.	Above 85°.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.
1878	77.4	15.1	96	52	6.36	8.0	1.5	16.7
1879	76.1	18.1	97	64	5.56	8.6	2.0	11.7
1880	75.0	18.9	97	54	3.83	6.8	1.0	18.0
1881	78.1	22.1	96	63	3 53	5.0	1.8	13.4
1882	70.6	8.2	99	52	3.69	8.2	3.3	13.6
1883	76.0	15.1	99	52	3.18	8.1	4.1	13.6
1884	74.8	12.6	97	52	6.94	11.0	4.4	11.0
1885	75.5	13.4	98	51	5.27	9.6	6.6	14.8
1886	77.4	24.6	102	55	1.31	4.5	3.3	20.5
1887	76.4	20.7	103	47	2.74	7.7	3.0	14.0
1888	78.8	20.0	105	45	3.06	7.1	6.0	10.0
1889	73.8	13.3	111	38	7.11	9.8	8.3	12.0
1890	78.8	23.8	112	40	3.38	5.3	3.3	16.7
Mean	76.0	19.2	....	....	4.31	7.7	3.7	13.8

AUGUST.

	Mean temperature.	Above 85°.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.
1878	75.7	....	97	51	3.14	4.0	0.7	21.0
1879	74.4	....	95	55	2.09	5.0	1.9	18.4
1880	75.0	....	97	51	4.86	7.1	4.8	17.0
1881	79.5	25.0	100	63	1.59	3.7	3.2	17.4
1882	73.0	18.4	91	52	1.58	4.0	1.9	18.6
1883	74.1	9.6	92	47	3.58	7.6	4.4	13.6
1884	70.2	3.0	93	46	3.76	7.1	7.0	13.7
1885	69.9	9.2	91	47	3.96	7.9	4.8	13.8
1886	75.8	19.7	100	40	2.97	7.0	3.7	15.0
1887	70.9	13.5	102	38	3.99	9.8	9.0	10.0
1888	72.1	8.6	103	34	3.64	8.8	8.6	11.5
1889	72.8	12.5	105	40	5.81	5.9	6.8	15.9
1890	72.2	10.8	108	34	3.16	8.4	6.6	13.2
Mean	73.2	15.7	....	....	3.12	6.4	4.7	15.7

SEPTEMBER.

	Mean temperature.	Above 85°.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.
1878	65.5	5.3	91	33	2.58	4.8	1.9	18.7
1879	61.1	3.9	91	28	1.86	5.1	1.5	19.0
1880	64.2	3.7	93	34	3.41	6.9	3.5	16.5
1881	67.3	10.3	99	36	4.05	6.5	3.8	17.2
1882	67.5	10.8	94	41	0.92	1.9	1.4	19.3
1883	60.8	2.0	91	37	3.38	7.1	6.4	14.0
1884	67.9	6.3	92	39	2.99	5.8	6.8	13.0
1885	64.0	5.0	92	43	2.34	6.2	6.0	16.4
1886	65.4	9.2	93	34	3.59	9.9	4.9	12.5
1887	64.4	6.5	91	30	3.04	7.9	7.5	9.0
1888	64.6	5.0	100	26	0.23	2.0	4.7	15.3
1889	61.6	3.0	101	24	1.76	4.8	9.1	12.9
1890	62.4	5.0	104	18	1.61	3.7	3.5	12.5
Mean	64.4	5.8	....	....	2.43	5.5	5.0	15.8

OCTOBER.

	Mean temperature.	Below 32°.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.
1878	50.2	8.5	81	15	0.47	1.8	6.0	15.3
1879	60.7	6.6	91	20	1.58	3.2	2.9	19.5
1880	48.9	3.7	82	23	2.06	4.2	8.1	14.5
1881	52.8	3.8	90	25	3.62	8.7	12.9	9.6
1882	54.9	6.4	83	31	2.79	6.4	5.4	12.4
1883	48.6	6.4	81	26	4.58	9.4	12.8	8.8
1884	55.9	5.3	86	26	2.36	5.9	5.0	17.6
1885	48.7	10.4	82	23	2.25	5.1	4.4	17.5
1886	56.4	5.7	87	16	1.25	3.6	8.8	18.3
1887	50.0	5.7	90	2	0.72	2.5	6.0	14.5
1888	49.6	4.5	86	12	0.99	3.4	5.5	17.8
1889	50.0	3.8	91	11	1.01	4.2	12.0	13.7
1890	52.0	4.0	92	8	1.43	4.8	7.4	13.6
Mean	52.2	5.8	....	....	1.93	4.9	7.1	14.9

NOVEMBER.

	Mean temperature.	Below 32°.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.
1878	40.8	18.4	....	....	0.78	1.6	3.1	16.3
1879	38.6	15.8	65	8	2.62	4.7	5.7	14.6
1880	25.3	22.4	66	-7	0.70	4.0	4.1	15.9
1881	34.2	18.2	61	3	1.26	3.3	5.3	12.5
1882	38.3	20.7	74	2	0.82	2.8	3.1	15.7
1883	37.8	20.1	67	6	0.26	1.2	2.6	19.5
1884	37.2	21.3	69	2	0.17	2.2	5.6	16.8
1885	38.1	20.4	72	19	1.09	3.3	7.3	12.8
1886	33.8	24.3	74	-5	1.26	4.5	6.8	16.2
1887	36.7	14.7	87	-32	0.81	1.3	6.0	16.0
1888	37.2	21.0	80	1	0.42	2.0	7.0	16.2
1889	33.5	23.0	75	-12	1.87	3.3	6.9	13.9
1890	41.2	18.5	79	-8	1.25	2.4	6.0	19.8
Mean	36.4	19.9	....	....	0.98	2.8	5.3	15.9

DECEMBER.

	Mean temperature.	Below 32°.	Below zero.	Highest temperature.	Lowest temperature.	Precipitation.	Days of precipitation.	Cloudy days.	Clear days.
1878	20.5	30.0	8.7	52	-8	0.44	2.9	4.2	13.2
1879	16.5	25.7	6.0	54	-17	0.91	8.2	7.7	13.1
1880	18.3	28.2	7.6	58	-26	0.55	8.7	14.0	11.1
1881	33.2	23.0	0.2	59	-9	0.90	8.4	6.9	11.2
1882	24.8	28.4	5.3	57	-15	1.01	5.4	8.2	9.4
1883	27.7	21.3	2.1	58	-9	0.71	8.4	7.5	12.7
1884	16.0	26.2	11.2	65	-18	0.86	9.7	11.0	7.9
1885	28.3	22.7	2.3	66	-9	1.19	4.4	8.0	14.4
1886	18.0	25.5	8.8	57	-12	0.90	6.5	9.0	9.5
1887	21.6	29.0	5.5	56	-28	0.87	6.0	9.0	7.0
1888	31.6	27.0	0.1	70	-8	0.49	3.9	6.8	8.1
1889	37.9	15.0	0.0	80	-14	0.14	1.1	9.7	11.5
1890	32.5	29.0	0.0	82	-10	0.11	0.3	6.0	18.2
Mean	25.1	25.4	4.1	....	....	0.70	4.5	8.3	11.3

ANNUAL.

	Mean temperature.	Below 32°.	Below zero.	Highest temperature.	Lowest temperature.	Precipitation.	Snow fall	Days of precipitation.	Cloudy days.	Clear days.
1878	51.4	117.9	18.2	97	-8	29.29	16.0	53.1	50.8	183.5
1879	49.4	135.8	22.2	97	-17	28.74	17.1	61.7	43.4	174.9
1880	49.7	140.4	14.3	97	-26	25.29	14.9	53.3	52.2	188.7
1881	49.3	140.6	16.6	100	-32	35.79	43.5	73.2	69.5	141.0
1882	50.6	131.6	8.0	99	-15	27.13	19.4	66.8	62.6	158.5
1883	47.6	131.8	15.5	99	-28	35.79	21.5	69.2	75.5	148.9
1884	47.8	136.0	29.5	97	-32	29.05	23.3	80.0	81.1	140.3
1885	46.8	142.9	29.4	98	-27	29.24	20.3	76.4	70.6	167.5
1886	48.0	146.0	25.7	102	-25	28.32	69.1	87.4	70.1	166.4
1887	48.4	137.8	28.6	103	-30	22.95	26.4	78.1	79.6	145.9
1888	48.3	132.0	32.1	105	-35	27.55	15.3	77.3	77.6	140.6
1889	50.6	112.2	5.2	111	-27	30.14	13.3	67.2	93.5	153.1
1890	50.7	132.8	13.7	112	-34	21.81	19.5	59.3	89.5	168.0
Mean	49.1	133.7	19.9	....	....	28.61	24.6	70.7	70.8	159.3

METEOROLOGICAL DATA.

Station.	Data.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Alliance	Mean temperature				47.2	54.6	67.3	74.6	68.2	58.7	45.6	35.5	31.6	
	Highest temperature				82	94	105	103	102	93	79	74	67	
	Lowest temperature				17	26	32	41	37	20	8	4	-3	
	Precipitation				1.78	1.24	1.86	2.28	1.10	0.09	0.14	0.45	0.15	
	Rainy days				10	9	6	8	8	1	8	3	2	
	Prevailing direction of wind				NE	NW	SE	SE	SE	SE	NW	SW	SW	
Ansley	Mean temperature	15.5	25.4	33.0	51.0	58.5	71.1	78.8	72.3	62.3	48.8	38.6	32.5	40.0
	Highest temperature	69	70	72	84	94	108	109	106	97	81	79	74	109
	Lowest temperature	-24	-26	0	9	20	38	47	39	24	20	6	-4	-26
	Precipitation	0.40	0.20	1.20	3.50	3.40	2.60	1.00	3.00	1.10	2.60	0.75	T	19.75
	Rainy days	1	1	3	6	5	7	5	10	8	8	2	0	46
Ashland	Mean temperature	15.9	27.4		57.2	65.0	75.2	79.9	76.8	60.5	51.9			
	Highest temperature	50	63		87	91	100	104	100	94	79	68	69	104
	Lowest temperature	-20	-14		38	29	46	52	48	30	21	18	4	-20
	Precipitation	0.94	0.31	0.98	0.96	4.34	4.92	4.58	3.07	1.51	1.09	1.43	0.50	24.63
	Rainy days	4	3	4	4	8	8	5	7	5	9	2	1	60
	Number clear days	16	11		16	20	22	23	21	15	16	24	24	
	Number fair days	7	5		9	7	5	6	3	10	7	8	1	
	Number cloudy days	8	12		2	4	3	2	7	5	8	8	6	
	Prevailing direction of wind	N	N		SE	N	S	S	N	S	S	S	S	
Bassett	Mean temperature					57.8	71.2	76.1	69.2	62.8		34.5	31.7	
	Highest temperature					96	98	106	95	100	80	72	70	
	Lowest temperature					34	52	58	52	31	22	12	-5	
	Precipitation						3.10	2.76	2.10	0.23	0.41	0.85	T	
	Rainy days						10	2	9	2	2	2	0	
Beaver City	Mean temperature									64.6	55.4	42.1	37.3	
	Highest temperature									102	88	72	82	
	Lowest temperature									37	24	16	2	
	Precipitation									0.04	0.29	1.00		
	Rainy days									2	2	2		
Bingham	Mean temperature	15.1	22.1				64.9							
	Highest temperature	57	58				98							
	Lowest temperature	-18	-19				36							
	Precipitation	0.50	0.10				3.52							
	Rainy days	1	1				9							

Burwell	Mean temperature	......	......	......	......	......	......	......	......	64.6	......	36.9	28.0	......
	Highest temperature	......	......	......	......	......	......	......	......	92	......	69	64	......
	Lowest temperature	......	......	......	......	......	......	......	......	40	......	8	0	......
	Precipitation	......	......	......	......	......	......	......	......	1.02	......	0.28	0.02	......
	Rainy days	......	......	......	......	......	......	......	......	5	......	2	1	......
Craig	Mean temperature	13.7	21.6	......	......	......	......	......	......	......	......	......	......	......
	Highest temperature	47	59	......	......	......	......	......	......	......	......	......	......	......
	Lowest temperature	-24	-21	......	......	......	......	......	......	......	......	......	......	......
	Precipitation	1.00	0.36	......	......	......	......	......	......	......	......	......	......	......
	Rainy days	6	2	......	......	......	......	......	......	......	......	......	......	......
Crawford	Mean temperature	......	......	......	......	......	......	......	......	......	......	37.4	29.2	......
	Highest temperature	......	......	......	......	......	......	......	......	......	......	55	54	......
	Lowest temperature	......	......	......	......	......	......	......	......	......	......	-4	16	......
Creighton	Mean temperature	11.2	21.4	27.5	48.4	55.2	......	74.4	67.8	59.8	46.6	34.8	26.8	......
	Highest temperature	56	58	61	85	92	......	105	103	101	72	66	59	......
	Lowest temperature	......	-23	-4	11	23	......	49	38	28	20	7	-2	......
	Precipitation	0.80	0.05	0.82	2.84	8.28	......	3.98	0.95	1.98	1.24	0.93	T	......
	Rainy days	......	1	4	8	9	......	9	6	8	5	2	0	......
	Prevailing direction of wind	NW	NW	NW	SE	NW	......	S	S	......	......	......	......	......
Crete	Mean pressure	30.28	30.20	30.13	30.05	......	29.88	29.93	30.00	30.06	29.99	30.17	30.21	
	Mean temperature	18.0	24.7	33.2	53.5	59.4	74.0	78.6	71.2	62.2	51.0	40.2	31.7	49.8
	Highest temperature	57	68	67	89	88	98	103	100	96	82	71	74	103
	Lowest temperature	-18	-14	3	20	28	44	52	45	31	25	16	5	-18
	Precipitation	1.26	0.18	1.35	1.31	3.46	4.48	2.47	2.93	1.14	1.64	1.42	0.30	21.94
	Rainy days	7	3	5	7	11	9	7	7	6	6	3	1	72
	Number clear days	10	5	8	12	10	7	16	8	10	14	20	15	135
	Number fair days	15	12	12	7	17	18	11	19	16	11	4	10	152
	Number cloudy days	6	11	11	11	4	5	4	4	4	6	6	6	78
	Prevailing direction of wind	NW	NW	N	NE	S	S	E	S	S	NW	NW	S	......
Culbertson	Mean temperature	......	......	......	48.3	61.7	77.8	87.7	......	......	......	......	......	......
	Highest temperature	......	......	......	88	98	105	110	......	......	......	......	......	......
	Lowest temperature	......	......	......	32	36	53	61	......	......	......	......	......	......
	Precipitation	0.28	0.16	0.05	5.24	0.65	8.42	0.78	2.89	0.04	0.33	0.47	0.00	14.31
	Rainy days	4	5	2	10	6	7	4	5	2	1	2	0	48
David City	Mean temperature	10.2	......	......	......	......	......	71.0	......	......	......	......	......	......
	Precipitation	1.42	0.60	0.25	1.05	1.18	5.25	2.20	2.49	1.25	0.85	1.45	T	17.94
	Rainy days	4	5	6	4	5	8	4	8	3	8	2	0	52
	Number clear days	11	12	......	12	9	10	13	11	13	12	20	18	......
	Number fair days	9	8	......	6	14	13	12	13	14	12	7	9	......
	Number cloudy days	11	8	......	12	8	7	6	7	8	7	8	4	......
	Prevailing direction of wind	N	N	N	N	NW	SE	SE	S	S	S	N	SE	......
De Soto	Mean temperature	16.8	24.9	31.0	54.7	59.0	72.9	77.5	70.0	61.1	50.5	39.7	32.3	49.2
	Highest temperature	49	64	62	87	92	96	102	97	95	78	67	65	102

METEOROLOGICAL DATA—CONTINUED.

STATION.	DATA.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
De Soto	Lowest temperature	-19	-11	-2	21	32	52	55	48	33	24	19	4	-19
	Precipitation	1.06	0.88	1.64	2.03	3.21	8.05	2.85	1.95	1.83	1.03	1.11	0.13	24.77
	Number rainy days	5	5	10	5	14	18	9	12	8	8	8	4	96
	Number clear days	7	5	6	9	5	6	12	13	9	9	15	15	111
	Number fair days	13	14	19	17	17	19	11	11	14	13	6	10	164
	Number cloudy days	11	9	6	4	9	5	8	7	7	9	9	6	90
	Prevailing direction of wind	N	N	N	N	NW	SE	S	SE	SE	NW	N	N	......
Dunning	Mean temperature	......	......	......	......	......	......	......	......	......	......	......	32.6	......
	Highest temperature	......	......	......	......	......	......	......	......	......	......	......	62	......
	Lowest temperature	......	......	......	......	......	......	......	......	......	......	......	0	......
	Precipitation	......	......	......	......	......	......	......	......	0.89	1.07	......	......	......
	Number rainy days	......	......	......	......	......	......	......	......	8	5	......	......	......
Elwood	Mean temperature	......	......	......	......	......	78.6	86.0	76.2	......	......	......	......	......
	Highest temperature	......	......	......	......	......	98	104	104	......	......	......	......	......
	Lowest temperature	......	......	......	......	......	58	70	56	......	......	......	......	......
	Precipitation	......	......	......	......	......	4.54	1.00	2.50	......	......	......	......	......
	Number rainy days	......	......	......	......	......	8	4	4	......	......	......	......	......
Erickson	Mean temperature	......	......	......	......	......	......	......	......	63.3	50.3	33.5	30.8	......
	Highest temperature	......	......	......	......	......	......	......	......	90	78	76	70	......
	Lowest temperature	......	......	......	......	......	......	......	......	36	25	9	5	......
	Precipitation	......	......	......	......	......	......	......	......	2.28	2.18	0.35	0.0	......
	Number rainy days	......	......	......	......	......	......	......	......	2	4	3	0	......
Fairbury	Precipitation	0.82	0.20	0.64	1.55	2.01	3.16	6.98	2.78	1.82	1.85	1.12	T	22.93
	Number rainy days	7	8	8	4	9	8	9	9	8	4	2	0	61
Fairfield	Mean temperature	14.9	27.0	34.0	53.4	57.6	77.5	78.9	71.2	62.4	50.3	41.5	30.2	49.9
	Highest temperature	55	70	68	87	88	98	107	100	94	78	73	70	107
	Lowest temperature	-16	-17	6	25	31	48	54	49	33	26	16	4	-17
	Precipitation	2.00	0.90	0.16	1.43	1.51	3.81	1.82	3.95	0.34	1.11	1.28	0.28	18.54
	Number rainy days	4	1	2	3	4	6	3	7	2	3	2	1	38
	Prevailing direction of wind	N	N	N	NW	NW	S	S	S	S	NW	N	N	......
Falls City	Mean temperature	20.6	27.6	33.6	......	......	......	......	......	......	......	......	......	......
	Precipitation	2.50	0.20	......	......	......	......	......	......	......	......	......	......	......

Fort Niobrara	Mean temperature	8.1	19.8	29.5	45.9	50.6	66.0	72.1	66.7	57.6	44.9	35.4	38.2	44.6
	Highest temperature	58	65	71	86	98	109	108	101	96	83	74	68	108
	Lowest temperature	-34	-29	-22	7	14	35	40	34	18	12	-8	-10	-34
	Precipitation	0.38	0.57	1.31	1.00	2.43	3.00	3.25	1.45	0.15	0.60	0.50	0.15	14.79
	Number rainy days	5	5	7	4	7	7	4	5	1	3	1	1	50
	Prevailing direction of wind	W	NE	N	N	N	W	NE	NE	N	N	N	S	....
Fort Omaha	Mean temperature	20.4	27.4	34.4	55.8	60.8	75.1	78.1	70.4	62.4	52.6	41.5	34.6	51.1
	Highest temparature	54	65	70	82	90	98	101	96	93	77	72	71	101
	Lowest temperature	-12	-8	4	21	32	50	55	49	31	23	19	5	-12
	Precipitation	1.22	0.70	1.97	1.51	2.75	6.15	2.00	1.02	3.00	0.90	0.38	0.08	21.68
	Number rainy days	6	2	5	3	4	6	2	11	4	4	2	1	50
Fort Robinson	Mean temperature	15.7	27.5	36.7	48.1	55.8	67.2	76.3	69.5	61.2	48.8	....	33.4	....
	Highest temperature	63	72	70	81	90	99	102	100	98	80	74	70	102
	Lowest temperature	-20	-28	4	18	27	36	51	36	27	19	10	5	-28
	Precipitation	0.29	0.66	1.54	1.82	2.51	0.60	2.30	1.84	0.00	0.06	0.13	0.01	11.76
	Number rainy days	5	12	11	11	10	6	....	....	0	....	3	1	....
	Prevailing direction of wind	W	NW	NW	SE	NW	NE	....	....	....	....	NW	NW	....
Fort Sidney	Mean temperature	18.0	28.6	39.0	48.6	56.0	67.8	79.6	71.3	65.5	48.2	....	....	....
	Highest temperature	58	64	75	80	98	99	103	100	94	77	73	65	103
	Lowest temperature	-13	-12	8	18	28	35	50	43	30	25	....	5	-13
	Precipitation	0.34	0.41	....	2.77	1.07	0.68	1.16	0.28	0.00	0.73	0.00	0.17	....
	Number rainy days	4	2	....	9	6	5	3	4	0	1	0	1	....
	Prevailing direction of wind	W	NW	NW	SW	NW	SW	SE	W	SW	SW	W	W	....
Franklin	Mean temperature	19.4	25.8	35.2	49.6	60.0	....	....	....	....	52.4	40.2	32.4	....
	Highest temperature	59	74	72	86	91	....	....	....	....	82	72	67	....
	Lowest temperature	-22	-19	9	15	25	....	....	....	....	29	14	4	-22
	Precipitation	0.20	....	....	0.25	1.20	....	....	....	....	0.76	0.72	0.81	....
	Number rainy days	3	....	....	1	4	....	....	....	....	4	3	1	....
	Number clear days	15	....	....	12	12	....	....	....	....	18	21	20	....
	Number fair days	0	....	....	0	0	....	....	....	....	9	5	7	....
	Number cloudy days	16	....	....	18	19	....	....	....	....	4	4	4	....
	Prevailing direction of wind	N	N	N	N	N	....	....	....	....	NW	NW	NW	....
Fremont	Mean temperature	15.9	24.2	30.9	54.6	59.6	72.9	77.4	69.8	61.5	51.0	40.2	32.3	49.2
	Highest temperature	51	60	62	83	90	95	103	96	91	78	68	63	103
	Lowest temperature	-19	-15	-7	19	32	50	54	48	31	23	18	5	-19
	Precipitation	1.51	0.36	1.61	0.92	2.72	6.98	4.14	1.38	2.31	0.58	0.66	0.08	23.15
	Number rainy days	5	3	6	5	11	11	7	9	3	6	3	3	77
Geneva	Precipitation	....	....	....	....	....	....	....	....	0.10	2.20	1.50	0.50	....
	Number rainy days	....	....	....	....	....	....	....	....	3	3	2	1	....
Genoa	Mean temperature	14.3	25.3	32.4	52.2	59.7	72.9	78.7	71.5	68.8	50.5	39.8	30.8	49.8
	Highest temperature	50	60	64	80	90	98	106	104	93	75	70	65	106
	Lowest temperature	-21	-24	1	19	30	50	56	50	32	29	11	3	-24
	Precipitation	1.31	0.44	1.16	1.31	3.40	4.88	1.51	2.66	3.84	1.28	1.07	0.00	22.81
	Number rainy days	4	5	6	4	11	11	6	10	4	3	2	0	66

METEOROLOGICAL DATA.—CONTINUED.

Station.	Data.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Genoa	Number clear days	9	6	10	11	6	7	13	13	13	12	22	19	141
	Number fair days	13	15	11	11	16	16	11	10	9	10	3	6	131
	Number cloudy days	9	7	10	8	9	7	7	8	8	9	5	6	93
	Prevailing direction of wind	NW	NW	NW	...	...	...	SE	SE	SE	...	NW	NW	...
Gering	Mean temperature	17.7	27.1	37.4	47.6	55.3	68.4	77.4	70.8	63.0	49.4	40.2	36.1	49.2
	Highest temperature	61	70	71	80	89	99	103	99	92	78	73	65	103
	Lowest temperature	-12	-18	11	21	30	36	55	43	32	23	16	8	-18
	Precipitation	0.35	0.43	0.37	3.19	1.95	0.62	1.75	1.41	T	0.16	0.56	0.27	11.06
	Number rainy days	2	5	5	11	11	3	6	9	0	2	3	2	59
	Prevailing direction of wind	NW	NW	NW	NW	NW	NW	SE	SE	NW	NW	NW	NW	...
Grand Island	Mean temperature	15.8	23.9	28.2	48.7	...	70.7	75.8	64.9	57.2	45.3	35.7	24.2	...
	Highest temperature	...	...	62	72	...	90	98	84	82	64	...	...	...
	Lowest temperature	...	-12	2	20	...	58	60	54	32	24	10	0	...
	Precipitation	0.55	0.20	0.23	1.12	1.32	2.94	0.55	2.72	1.27	0.65	1.05	T	12.60
	Number rainy days	4	4	4	3	8	9	4	10	3	2	3	0	54
	Prevailing direction of wind	NW	NW	NW	SE	NW	SE	S	...	SE	...	W	NW	...
Grant	Precipitation	0.00	T	T	4.26	1.18	4.61	...	4.05	0.05	0.41	0.40	0.20	...
	Number rainy days	0	0	0	5	3	6	...	8	1	4	1	1	...
Harvard	Mean temperature	...	...	...	...	...	...	...	75.8	61.6	...	...	...	...
	Highest temperature	...	...	...	...	...	...	...	102	93	...	...	...	...
	Lowest temperature	...	...	...	...	...	...	...	62	33	...	...	...	...
	Precipitation	...	...	...	...	...	...	...	2.96	0.49	...	...	...	...
	Number rainy days	...	...	...	...	...	...	...	8	3	...	...	...	...
	Prevailing direction of wind	...	...	...	...	...	...	...	SE	SE	...	...	...	...
Hastings	Highest temperature	...	...	...	...	92	100	108	104	99	80	70	66	...
	Lowest temperature	...	...	...	...	32	50	58	52	34	26	12	4	...
	Precipitation	...	...	...	...	1.62	1.12	1.88	2.36	0.50	0.75	1.75	0.25	...
	Number rainy days	...	...	...	...	4	4	2	8	2	2	3	1	...
	Prevailing direction of wind	...	...	...	...	NW	SE	SE	...	...	NW	NW	SW	...
Hay Springs	Mean temperature	11.9	23.0	33.8	45.5	53.1	65.0	74.2	68.8	59.9	45.2	34.1	28.5	45.2
	Highest temperature	...	62	71	82	91	102	102	98	90	76	70	63	102
	Lowest temperature	-19	-21	-1	16	28	36	52	43	23	17	12	7	-21
	Precipitation	0.61	0.40	1.01	1.73	2.24	4.55	2.75	1.27	0.00	0.43	0.61	0.35	15.95
	Number rainy days	8	7	6	11	8	7	8	6	0	3	3	2	64

Hay Springs	Number clear days	16	10	9	10	10	15	19	18	18	20	22	18	185
	Number fair days	10	10	11	10	16	5	11	8	11	8	4	9	113
	Number cloudy days	5	7	11	10	4	5	1	5	1	3	3	4	59
	Prevailing direction of wind	SW	NE	NW	S	NW	SW	S	S	S	NW	NW	N	....
Hebron	Mean temperature	20.2	27.5	37.2	56.2	63.9	75.5	80.5	72.5	64.8	53.3	40.8	33.8	52.1
	Highest temperature	60	70	70	93	92	99	103	97	96	82	66	64	103
	Lowest temperature	-17	-12	8	28	30	51	55	49	32	24	19	7	-17
	Precipitation	0.90	0.15	0.51	2.80	1.05	3.45	4.73	2.63	1.70	2.37	1.45	0.00	21.72
	Number rainy days	....	....	....	8	7	8	6	9	3	8	2	0	....
Holdrege	Mean temperature	....	....	....	....	....	74.0	80.0	74.7	....	....	....	....	....
	Highest temperature	....	....	....	....	....	100	106	103	100	78	....	....	106
	Lowest temperature	....	....	....	....	....	53	60	53	38	26	....	-2	....
	Precipitation	....	....	....	....	....	1.71	0.75	1.00	0.45	0.40	1.00	0.00	....
	Number rainy days	....	....	....	....	....	10	2	6	2	1	2	0	....
Howe	Mean temperature	20.2	27.5	35.7	58.0	63.0	75.6	80.5	78.0	64.5	55.0	42.2	34.4	52.5
	Highest temperature	50	60	67	90	84	98	102	97	93	78	72	65	102
	Lowest temperature	-19	-12	4	23	34	53	62	49	36	22	25	5	-19
	Precipitation	2.08	0.30	0.44	0.80	3.49	3.75	4.21	2.79	2.78	1.54	0.85	0.00	23.03
	Number rainy days	7	3	10	4	18	12	9	10	5	6	3	0	82
	Number clear days	10	11	12	....	14	12	18	....	10	17	18	19	....
	Number fair days	7	7	8	....	7	10	5	....	6	10	3	5	....
	Number cloudy days	14	10	11	....	10	8	8	....	12	4	9	6	....
	Prevailing direction of wind	N	N	N	....	N	S	S	....	S	S	N	S	....
Imperial	Mean temperature	....	....	....	....	....	77.5	89.6	81.7	66.1	....	41.4	32.5	....
	Highest temperature	....	....	....	....	....	100	106	105	91	....	68	6	106
	Lowest temperature	....	....	....	....	....	57	68	66	58	....	18	8	....
	Precipitation	....	....	....	....	....	3.24	0.62	2.25	....	....	0.20	....	....
	Number rainy days	....	....	....	....	....	4	8	2	....	....	1	....	....
Kennedy	Mean temperature	15.8	26.2	34.7	48.8	....	68.6	75.2	69.6	63.8	49.0	38.2	32.6	....
	Highest temperature	62	70	75	81	....	101	106	100	103	87	70	68	106
	Lowest temperature	-16	-16	10	20	....	44	59	48	30	30	10	8	-16
	Precipitation	0.60	0.31	0.82	1.41	2.57	6.66	2.82	1.52	0.07	0.81	0.20	0.08	17.87
	Number rainy days	8	7	7	6	10	11	8	18	4	5	1	3	78
	Number clear days	17	6	16	17	13	11	16	11	17	14	25	17	180
	Number fair days	10	16	12	9	14	15	12	17	12	15	4	12	148
	Number cloudy days	4	6	3	4	4	4	3	3	1	2	1	2	37
	Prevailing direction of wind	NW	NW	NW	SE	SE	SE	SE	SE	SE	NW	NW	NW	....
Kimball	Mean temperature	20.1	31.0	38.8	48.4	56.0	67.9	76.4	70.4	61.4	48.2	38.2	34.7	49.8
	Highest temperature	57	69	73	81	93	101	106	103	93	80	78	67	106
	Lowest temperature	-10	-18	8	17	28	85	50	41	29	21	9	6	-18
	Precipitation	0.00	T	T	2.49	0.87	0.75	1.90	2.05	0.00	0.56	3.05	0.53	12.12
	Number rainy days	0	0	0	7	5	3	5	5	0	1	8	2	30

METEOROLOGICAL DATA—CONTINUED.

STATION.	DATA.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Lexington	Mean temperature	18.5	27.2	37.0	....	61.9	74.8	77.2	74.4	62.7	51.9	40.0	34.4	....
	Highest temperature	60	70	67	....	87	97	103	103	96	80	78	69	103
	Lowest temperature	-15	-15	0	....	32	54	59	52	25	17	8	-2	-15
	Precipitation	0.74	0.10	0.16	2.13	1.55	2.46	1.22	1.59	0.07	1.01	1.14	0.00	12.17
	Number rainy days	3	2	3	3	6	7	4	9	4	1	2	0	44
	Number clear days	14	6	7	....	4	4	4	7	12	21	22	23	....
	Number fair days	8	11	12	....	13	19	21	16	11	4	8	5	....
	Number cloudy days	9	11	12	....	11	7	6	8	7	6	5	3	....
	Prevailing direction of wind	NW	NW	NW	....	N	N	S	S	S	N	NW	NW	....
Lincoln	Mean pressure	30.28	30.19	30.17	30.05	29.92	29.91	29.91	30.01	30.13	29.98	30.20	30.20	30.08
	Mean temperature	19.5	24.8	32.3	54.0	60.2	74.4	79.6	71.4	63.0	53.7	41.7	33.5	50.7
	Highest temperature	53	67	66	84	88	99	103	98	95	80	69	71	103
	Lowest temperature	-16	-11	-6	21	31	54	54	47	34	25	20	9	-16
	Precipitation	0.86	0.06	0.72	0.82	3.43	3.14	1.72	1.84	0.98	1.12	0.61	0.00	14.80
	Number rainy days	7	3	3	1	8	5	4	10	5	6	8	0	55
	Number clear days	8	8	10	13	6	10	15	10	15	10	15	16	136
	Number fair days	14	9	11	10	19	10	13	12	7	12	10	9	136
	Number cloudy days	9	11	10	7	6	10	8	9	8	9	5	6	93
	Prevailing direction of wind	....	....	....	S	N	S	S	S	S	SW	N	S	....
Long Pine	Mean temperature	....	....	....	....	57.5	73.1	73.5	72.7	58.5	49.0	....	....	....
	Highest temperature	....	....	....	....	100	103	111	100	82	70	....	69	103
	Lowest temperature	....	....	....	....	20	50	50	40	32	28	-4	10	....
	Precipitation	....	....	....	....	....	....	3.50	2.60	1.00	0.25	1.50	1.00	....
	Number rainy days	....	....	....	....	....	....	8	16	2	1	3	6	....
	Prevailing direction of wind	....	....	....	....	NW	....	S	S	NW	NW	NW	....	....
Marquette	Highest temperature	53	67	72	92	98	101	108	104	93	77	70	68	108
	Lowest temperature	-17	-15	-2	24	36	48	65	45	36	30	14	4	-17
	Precipitation	0.97	0.42	0.47	0.44	1.22	2.60	0.96	1.92	1.54	0.45	0.84	0.00	11.83
	Number rainy days	4	3	5	3	5	6	4	9	3	3	2	0	47
Minden	Mean temperature	18.8	24.8	34.0	52.9	61.2	78.3	80.2	72.1	64.0	51.3	37.8	31.1	50.1
	Highest temperature	56	58	70	88	90	103	108	108	100	78	72	66	108
	Lowest temperature	-18	-20	-2	20	26	50	64	52	32	30	10	-4	-20
	Precipitation	1.32	0.85	0.98	2.11	2.86	4.55	1.45	1.33	1.30	0.80	1.30	0.00	17.80
	Number rainy days	5	3	5	5	10	11	7	6	4	2	4	0	62
	Number clear days	11	8	....	....	....	9	16	9	15	15	20	17	....
	Number fair days	12	10	....	....	....	16	14	19	11	11	7	11	....

Mullen	Number cloudy days	8	10	....	....	....	5	1	3	4	5	3	3	....
	Prevailing direction of wind	NW	N	....	N	N	S	S	SE	S	N	W	S	....
	Precipitation	0.50	0.40	0.41	....	3.06	....	4.01	1.32	....	....	....	....	....
	Number rainy days	....	2	2	....	6	....	7	3	....	....	....	....	....
Nebraska City	Mean temperature	19.3	25.5	32.8	56.7	60.5	73.9	75.4	70.0	61.3	49.7	41.7	33.6	50.0
	Highest temperature	52	60	69	86	85	99	106	98	88	78	67	70	106
	Lowest temperature	-19	-11	2	32	34	49	55	48	33	24	18	7	-19
	Precipitation	1.30	0.40	1.51	0.64	2.80	5.21	2.50	4.02	2.73	1.49	1.39	0.00	23.99
	Number rainy days	6	3	7	4	8	8	2	10	5	6	4	0	63
North Loup	Mean temperature	13.9	23.2	32.5	52.4	59.1	70.9	78.3	70.3	62.5	51.8	39.1	31.1	48.7
	Highest temperature	56	58	64	84	94	95	102	105	94	78	70	61	105
	Lowest temperature	-24	-28	-1	29	21	42	48	40	23	20	7	-2	-28
	Precipitation	1.25	0.05	0.70	1.68	4.63	3.63	0.42	2.86	1.59	2.18	0.87	T	19.31
	Number rainy days	2	1	2	4	8	12	4	10	5	4	2	0	54
North Platte	Mean pressure	30.23	30.13	30.08	30.05	29.92	29.89	29.94	30.01	30.06	30.04	30.24	30.21	30.07
	Mean temperature	19.0	27.0	36.0	50.0	58.0	70.0	74.0	71.0	63.0	51.0	39.0	34.0	49.3
	Highest temperature	66	69	73	85	92	98	103	100	96	81	77	70	103
	Lowest temperature	-12	-16	4	20	28	39	53	45	30	21	6	4	-16
	Precipitation	0.35	0.38	0.27	4.46	0.90	2.06	0.39	2.42	0.19	0.84	0.42	0.03	12.71
	Number rainy days	7	4	5	12	9	7	8	10	3	4	1	3	73
	Number clear days	13	6	9	8	6	5	8	6	11	12	20	17	121
	Number fair days	13	15	15	12	24	21	20	21	15	12	6	10	184
	Number cloudy days	5	7	7	10	1	4	3	4	4	7	4	4	60
	Prevailing direction of wind	W	NW	NW	SE	NW	SE	E	SE	SE	W	W	W	....
	Mean humidity	73	68	46	63	59	63	59	62	61	56	61	56	60.6
Oakdale	Mean temperature	10.9	21.3	29.9	52.8	58.0	71.1	76.6	69.5	61.1	48.4	37.3	27.2	47.0
	Highest temperature	59	62	64	86	92	97	103	103	95	75	71	68	103
	Lowest temperature	-29	-28	-4	17	28	45	48	40	24	22	8	0	-29
	Precipitation	0.85	0.41	1.38	1.69	8.00	3.23	1.24	1.62	0.82	2.39	0.85	0.01	17.49
	Number rainy days	6	4	10	4	14	13	9	8	5	6	4	1	84
	Number clear days	12	8	9	12	8	9	14	13	13	11	16	14	139
	Number fair days	7	8	12	7	13	12	11	10	11	10	8	11	120
	Number cloudy days	12	12	10	11	10	9	6	8	6	10	6	6	106
	Prevailing direction of wind	NW	NW	NW	NW	NW	NW	S	S	S	NW	NW	NW	....
Omaha	Mean pressure	30.24	30.15	30.14	30.06	29.91	29.91	29.98	30.05	30.10	30.01	30.17	30.18	30.08
	Mean temperature	18.0	25.0	33.0	55.0	60.0	74.0	78.8	70.0	63.0	52.0	42.0	35.0	50.5
	Highest temperature	52	64	65	86	89	98	105	99	74	76	70	71	105
	Lowest temperature	-14	-12	1	23	33	52	55	48	36	26	20	5	-14
	Precipitation	1.44	0.54	1.35	1.55	2.72	5.01	3.74	1.02	2.50	1.09	1.01	0.08	22.08
	Number rainy days	11	8	10	6	12	12	8	11	7	9	3	1	98
	Number clear days	8	8	6	10	7	10	16	7	11	12	16	14	125
	Number fair days	12	8	11	13	18	13	10	18	13	9	7	11	143
	Number cloudy days	11	12	14	7	6	7	5	5	6	10	7	6	96
	Prevailing direction of wind	NW	NW	N	SE	NW	S	S	S	NW	S	N	S	....
	Mean humidity	74	72	71	56	58	67	68	68	69	69	71	66	67.0

METEOROLOGICAL DATA—CONTINUED.

STATIONS.	DATA.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
O'Neill	Mean temperatnre							77.2	70.0	62.9	51.0	40.9	32.2	
	Highest temperature							104	100	95	85	79	80	
	Lowest temperature							57	46	35	28	12	9	
	Precipitation						3.28	2.37	3.17	0.11	0.68	0.35	0.00	
	Number rainy days						10	9	10	3	4	1	0	
	Prevailing direction of wind									S	W	W	N	
Ough	Precipitation						1.82	1.20	1.55	0.00	0.00	0.30		
	Number rainy days						6	5	4	0	0	1		
Palmer	Mean temperature	11.9	21.0	29.2	48.5	55.5	71.8	82.3	72.3	58.8	44.5	36.6	29.1	46.8
	Highest temperature	52	64	64	82	92	96	106	100	92	72	70	64	106
	Lowest temperature	-16	-24	0	24	28	52	70	52	25	20	6	-2	-24
	Precipitation	2.20	0.40	0.40	0.60	2.00	2.40	0.45	0.80	0.80	0.70	0.80	T	11.55
	Number rainy days	4	2	4	3	4	4	2	4	3	1	2	0	33
	Prevailing direction of wind	N	N	N	N	N	S	S	S	S	S	N	N	
Paxton	Precipitation					0.84		1.10	2.85	1.40	0.04			
	Number rainy days					3		1	3	5	2			
Plattsmouth	Precipitation	1.55	0.25	1.40	1.60	4.86	6.45	5.45	3.85	5.39	2.25		0.00	
Precept	Precipitation	0.28	0.18	0.00	2.11	1.56	4.29	1.05	3.69	0.06	0.87	1.19	0.00	15.28
Purple Cane	Mean temperature	22.0	25.2	36.0	60.3	63.3	78.0	80.0	75.2	67.2	58.0	47.2	40.3	54.4
Ravenna	Mean temperature	16.0	25.0	34.1	52.4	59.0	72.0	78.8	70.4	60.1	50.4	39.3	32.9	49.2
	Highest temperature	61	68	69	88	90	100	105	104	94	76	72	71	105
	Lowest temperature	-21	-22	2	16	24	40	52	40	24	22	10	2	-22
	Precipitation	1.83	0.52	0.83	2.76	2.85	2.75	1.66	1.98	0.86	2.04	1.03	0.04	19.15
	Number rainy days	5	5	7	7	10	8	6	10	4	5	3	2	72
	Number clear days	15	13	5	12	11	8	20	14	16	17	21	23	175
	Number fair days	11	9	11	9	17	17	10	15	12	9	6	3	129
	Number cloudy days	5	6	15	9	8	5	1	2	2	5	3	5	61
	Prevailing direction of wind	N	NW	SW	NE	S	SE	S	S	S	S	W	W	
Sargent	Mean temperature			32.1	51.3									
	Highest temperature		64	71	84									
	Lowest temperature		-23	0	20									

	Precipitation		0.55	0.76	1.67				3.64	0.71	1.24	0.49	0.00	
	Number rainy days		4	8	4				9	4	5	2	0	
Saronville	Mean temperature	11.9												
	Precipitation	1.10												
	Number rainy days	3												
Seward	Mean temperature										52.8	46.2	32.8	
	Highest temperature										78	72	70	
	Lowest temperature										28	26	10	
	Precipitation									1.01	0.74	1.40	T	
	Number rainy days									4	4	8	0	
Sioux City, Ia.	Mean pressure	30.27	30.15	30.14	30.03	29.85	29.87	29.93	30.01	30.06	29.98	30.16	30.17	30.05
	Mean temperature	14.0	22.9	28.4	52.1	57.8	72.4	76.0	69.0	61.8	50.2	40.4	31.5	48.0
	Highest temperature	52	62	58	88	88	96	104	93	89	72	74	68	104
	Lowest temperature	-20	-18	-7	13	30	50	50	43	34	24	15	-3	-20
	Precipitation	1.14	0.40	2.12	1.32	2.29	3.61	2.59	3.64	2.36	1.84	0.84	0.10	22.25
	Number rainy days	7	6	12	9	12	12	7	12	7	9	4	3	100
	Number clear days	10	9	8	12	8	10	16	11	11	7	18	15	135
	Number fair days	10	8	12	8	14	13	10	10	11	14	7	9	126
	Number cloudy days	11	11	11	10	9	7	5	10	8	10	5	7	104
	Mean humidity	79	66	68	58	57	70	65	66	67	68	71	66	66.8
	Prevailing direction of wind	NW	N	NW	S	S	S	S	S	S	S	NW	NW	
Superior	Mean temperature										49.2	38.1	30.6	
	Highest temperature										92	68	58	
	Lowest temperature										28	20	18	
	Precipitation										3.28	1.12	0.17	
	Number rainy days										4	1	1	
Syracuse	Mean temperature	20.1	26.5	33.4	56.2	62.1	76.5	81.2	72.6	63.2	51.1	41.5	33.0	51.4
	Highest temperature	56	64	66	85	89	101	106	100	94	75	67	67	106
	Lowest temperature	-14	-8	6	27	41	59	68	52	40	26	20	8	-14
	Precipitation	1.09	0.31	1.24	0.93	2.87	4.00	3.17	2.83	2.47	1.28	1.23	T	21.42
	Number rainy days	8	2	5	5	11	8	6	12	4	5	3	0	69
Tecumseh	Mean temperature	19.4	25.6	35.6	56.9	61.2	76.1	79.6	70.9	61.8	52.2	41.1	33.4	51.2
	Highest temperature	52	56	63	90	86	96	100	95	90	79	65	60	100
	Lowest temperature	-18	-12	-4	30	32	56	60	46	32	21	13	2	-18
	Precipitation	1.40	0.40	0.60	1.45	3.30	1.30	3.97	1.79	2.16	1.52	1.25	0.25	19.39
	Number rainy days	3	2	3	7	10	5	7	8	4	5	2	1	57
	Number clear days		9	12	10	9	13	16	15		14	22	17	
	Number fair days		10	11	6	9	12	15	8		11	0	6	
	Number cloudy days		9	8	10	10	2	0	8		6	8	8	
	Prevailing direction of wind		NW		NW			S	SE		S	N	N	
Tekamah	Mean temperature			40.5	56.8	56.8		79.9	72.9	59.5	53.8	40.7	33.0	
	Highest temperature			63	83	79		102	97	95	73	71	68	
	Lowest temperature			16	16	32		53	55	30	24	13	2	

METEOROLOGICAL DATA—CONTINUED.

STATIONS.	DATA.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Tekamah	Precipitation	....	....	2.60	2.16	2.78	18.70	1.86	2.96	1.18	1.50	1.35	T	....
	Number rainy days	....	....	5	4	8	8	5	10	4	4	8	0	....
	Number clear days	....	....	....	10	7	....	18	12	11	14	20	19	....
	Number fair days	....	....	....	11	10	....	6	12	14	10	6	6	....
	Number cloudy days	....	....	....	9	5	....	7	7	5	7	4	6	....
	Prevailing direction of wind	....	....	....	N	NW	....	S	SE	S	N	N	N	....
	Mean humidity	....	....	78	61	68	....	68	73	....	69	....	80	....
Thedford	Mean temperature	....	....	....	....	....	78.4	82.0	75.3	74.4	....	....	....	....
	Highest temperature	....	....	....	....	....	108	112	102	106	....	....	....	....
	Lowest temperature	....	....	....	....	....	56	62	55	60	....	....	....	....
	Precipitation	....	....	....	....	....	2.00	0.73	2.02	0.79	....	....	....	....
	Number rainy days	....	....	....	....	....	9	5	6	3	....	....	....	....
Valentine	Mean pressure	30.29	30.18	30.10	30.05	29.92	29.87	29.91	29.97	30.03	30.03	30.23	30.18	30.06
	Mean temperature	11.0	23.0	32.2	50.0	55.2	68.8	76.0	69.3	62.0	49.0	38.0	32.0	47.2
	Highest temperature	59	66	69	83	91	98	103	98	92	80	75	68	103
	Lowest temperature	-24	-22	-3	17	26	44	54	44	27	19	1	1	-24
	Precipitation	0.69	1.49	2.28	1.33	1.91	3.09	4.39	2.04	0.68	0.64	0.93	0.32	19.79
	Number rainy days	8	10	11	5	10	13	11	12	4	5	5	2	96
	Number clear days	7	9	7	17	11	14	19	12	12	9	16	12	145
	Number fair days	10	8	12	8	13	11	10	19	11	13	10	13	138
	Number cloudy days	14	11	12	5	7	5	2	0	7	9	4	6	82
	Mean humidity	70	63	67	58	55	61	60	65	64	66	71	71	64.2
	Prevailing direction of wind	W	N	NW	N	N	S	SE	S	S	W	W	SW	....
Wallace	Mean temperature	....	....	....	....	....	....	....	....	60.2	49.7	36.6	32.5	....
	Highest temperature	....	....	....	....	....	....	....	....	94	78	73	70	....
	Lowest temperature	....	....	....	....	....	....	....	....	37	28	12	9	....
	Precipitation	....	....	....	....	....	....	....	....	0.32	0.30	0.20	0.00	....
	Number rainy days	....	....	....	....	....	....	....	....	1	1	1	0	....
	Number clear days	....	....	....	....	....	....	....	....	....	....	21	23	....
	Number fair days	....	....	....	....	....	....	....	....	....	....	4	5	....
	Number cloudy days	....	....	....	....	....	....	....	....	....	....	5	8	....
Weeping Water	Mean temperature	18.5	24.1	30.9	53.6	57.9	73.2	76.1	69.0	61.7	53.1	38.6	30.8	48.9
	Highest temperature	53	65	65	87	91	101	107	102	95	76	69	72	107
	Lowest temperature	-23	-15	2	18	26	48	51	45	29	20	17	1	-23
	Precipitation	1.37	0.50	1.37	1.00	5.75	5.61	2.50	5.36	1.00	0.62	1.87	0.00	26.95
	Number rainy days	8	9	8	3	14	14	5	6	3	9	8	0	82
	Prevailing direction of wind	NE	....	NE	N	....	SE	SE	SW	SE	NE	N	NE	....

West Hill	Mean temperature	13.8	21.0	33.4	49.1	57.1	70.1	77.0	70.0	64.6	48.0	36.5	30.0	47.6
	Highest temperature	54	59	68	88	89	96	103	100	91	73	65	65	103
	Lowest temperature	-21	-24	-4	28	36	55	63	49	41	27	10	0	-24
	Precipitation	0.80	0.30	1.07	0.31	3.06	4.86	1.86	2.41	3.62	1.80	0.96	0.00	20.05
	Number rainy days	7	3	6	2	10	9	4	12	5	2	4	0	64
	Number clear days	12	8	12	13	11	11	16	12	14	11	20	...	...
	Number fair days	13	12	9	10	10	4	7	9	9	13	6	...	...
	Number cloudy days	6	8	10	7	10	15	8	10	7	7	4	...	...
	Prevailing direction of wind	NW	NW	NW	NW	NW	SE	S	...	...	NW	NW	NW	...
West Point	Highest temperature	50	62	62	80	85	91	95	95	90	76	68	55	95
	Lowest temperature	-20	-8	7	...	41	...	67	61	...	42	...	-6	...
	Precipitation	1.10	0.50	2.00	0.70	6.75	8.95	1.25	2.50	1.15	2.76	1.31	0.10	29.07
	Number rainy days	3	4	4	1	12	10	6	11	6	4	2	4	67
	Prevailing direction of wind	NW	NW	NW	S	N	S	SE	SE	SE	SE	N	S	...
Weston	Mean temperature	17.0	30.0	32.2	52.2	60.0	76.0	84.0	...	...	...	...	...	...
	Highest temperature	58	70	72	89	90	100	106	...	...	...	...	...	...
	Lowest temperature	-17	-10	5	29	35	56	54	...	...	...	...	...	...
	Precipitation	0.77	0.21	1.68	0.57	3.16	6.91	3.52	...	...	...	...	...	...
	Number rainy days	7	4	4	2	12	8	3	...	...	...	...	...	...
	Prevailing direction of wind	N	N	N	N	NW	N	S	...	...	...	...	...	...
Whitman	Mean temperature	...	...	...	...	...	...	...	...	62.2	50.8	38.2	32.8	...
	Highest temperature	...	...	...	...	...	...	...	...	90	90	72	64	...
	Lowest temperature	...	...	...	...	...	...	...	...	28	28	16	8	...
	Precipitation	...	...	...	...	...	...	...	...	0.00	0.27	0.40	T	...
	Number rainy days	...	...	...	...	...	...	...	...	0	1	1	0	...
Wilcox	Precipitation	...	...	...	1.65	0.97	5.09	1.65	1.37	1.65	0.22	1.05	0.10	...
	Number rainy days	...	...	...	...	4	8	6	7	8	3	2	2	...
Yankton, S Dak	Mean pressure	30.22	30.12	30.10	30.02	29.86	29.84	29.90	29.97	30.02	29.97	30.15	30.15	30.03
	Mean temperature	11.4	21.0	28.6	51.4	56.2	71.0	76.0	70.0	62.0	50.0	39.0	31.0	47.3
	Highest temperature	56	60	56	86	88	93	98	99	93	75	74	67	99
	Lowest temperature	-22	-17	-7	15	32	50	51	41	33	22	9	-7	-22
	Precipitation	0.56	0.46	1.07	1.84	4.18	3.59	4.27	2.16	1.16	0.92	0.79	0.25	21.25
	Number rainy days	6	5	9	6	13	13	9	9	7	9	5	4	95
	Number clear days	9	5	7	11	7	7	17	13	16	12	20	17	141
	Number fair days	11	10	10	9	11	17	9	14	12	10	6	12	131
	Number cloudy days	11	13	14	10	13	6	5	4	2	9	4	2	93
	Mean humidity	79	73	72	58	59	68	65	48	65	76	74	70	67.2
	Prevailing direction of wind	NW	NW	NW	SE	NW	SE	SE	SE	SE	NW	NW	NW	...
York	Precipitation	...	...	...	...	...	...	...	5.36	0.66	0.41	1.05	0.00	...
	Number rainy days	...	...	...	...	...	...	...	6	2	2	2	0	...

METEOROLOGICAL DISTRICTS.

For the purpose of comparing meteorological conditions in different parts of Nebraska the state has been divided into six sections of very nearly equal extent, as shown on the maps; these sections are identical with those adopted by the State Horticultural Society in January, 1888, as representing natural botanical districts of the state; the counties included are as follows:

THE SOUTHEASTERN SECTION.

Polk.	Seward.	Saline.	Richardson.
Butler.	York.	Gage.	Pawnee.
Saunders.	Hamilton.	Johnson.	Jefferson.
Cass.	Clay.	Otoe.	Thayer.
Lancaster.	Fillmore.	Nemaha.	Nuckolls.

THE NORTHEASTERN SECTION.

Sarpy.	Douglas.	Washington.	Dodge.
Colfax.	Platte.	Burt.	Cuming.
Stanton.	Madison.	Antelope.	Holt.
Pierce.	Wayne.	Dakota.	Dixon.
Cedar.	Knox.	Thurston.	Boyd.

THE CENTRAL SECTION.

Hall.	Buffalo.	Dawson.	Custer.
Sherman.	Howard.	Merrick.	Nance.
Greeley.	Valley.	Boone.	Wheeler.
Garfield.	Loup.	Blaine.	

THE SOUTHWESTERN SECTION.

Webster.	Franklin.	Harlan.	Furnas.
Red Willow.	Hitchcock.	Dundy.	Chase.
Hayes.	Frontier.	Gosper.	Phelps.
Kearney.	Adams.	Keith (south of the Platte).	Lincoln (south of the Platte).
Perkins.			

THE NORTHWESTERN SECTION.

Brown.	Keya Paha.	Cherry.	Sheridan.
Dawes.	Box Butte.	Sioux.	Rock.

THE WESTERN SECTION.

Cheyenne.	Grant.	Arthur.	McPherson.
Thomas.	Logan.	Keith (north of the Platte).	Lincoln (north of the Platte).
Hooker.	Banner.	Scott's Bluff.	
Kimball.	Deuel.		

TEMPERATURE.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
Mean for southeastern section	17.6	26.5	33.7	55.3	61.0	75.2	78.8	72.2	62.4	52.0	41.2	32.5	50.7
Mean for northeastern section	14.6	23.1	31.8	53.0	58.0	72.4	77.2	69.9	61.7	50.3	39.4	31.4	48.6
Mean for central section	15.1	24.3	32.8	50.9	59.0	72.0	78.5	70.9	61.7	49.1	38.3	30.6	48.6
Mean for southwestern section	19.1	25.3	34.6	50.3	61.0	76.2	84.7	76.2	63.7	52.2	39.6	33.2	51.3
Mean for western section	18.7	28.4	37.8	48.6	56.3	70.5	77.9	71.7	64.9	49.5	38.9	34.3	49.7
Mean for northwestern section	12.9	23.6	33.3	47.6	54.9	68.0	75.4	69.2	60.5	47.4	36.2	32.2	46.8
Mean for the state	16.3	25.2	34.0	51.0	58.4	72.4	78.8	71.7	62.5	50.1	38.9	32.5	49.3
PRECIPITATION.													
Mean for southeastern section	1.24	0.35	0.89	1.12	3.00	4.27	3.38	3.16	1.61	1.43	1.25	0.11	21.81
Mean for northeastern section	1.04	0.41	1.60	1.49	3.34	6.54	2.60	2.06	1.94	1.39	0.88	0.07	23.36
Mean for central section	1.18	0.31	0.68	1.85	2.74	3.02	0.97	2.41	1.31	1.48	0.73	0.01	16.69
Mean for southwestern section	0.42	0.17	0.24	2.60	1.36	3.44	1.10	2.30	0.44	0.42	0.80	0.14	13.43
Mean for western section	0.31	0.32	0.26	3.23	1.47	1.22	1.56	1.76	0.34	0.44	0.89	0.20	12.00
Mean for northwestern section	0.51	0.59	1.39	1.51	2.15	3.30	3.01	1.74	0.28	0.42	0.65	0.26	15.81
Mean for the state	0.78	0.36	0.84	1.97	2.34	3.63	2.10	2.24	0.99	0.93	0.87	0.13	17.18
RAINY DAYS.													
Mean for southeastern section	5.6	3.4	5.0	3.9	8.9	8.1	5.3	8.4	3.7	4.8	2.4	0.3	59.8
Mean for northeastern section	6.2	3.9	7.4	4.4	10.8	10.6	7.0	10.1	5.6	6.2	2.9	1.5	76.6
Mean for central section	3.3	3.0	4.6	4.2	7.4	8.3	4.4	9.0	3.6	3.3	2.2	0.3	53.5
Mean for southwestern section	3.0	2.7	2.3	5.2	5.2	7.1	4.1	5.0	1.9	2.0	2.0	0.6	41.1
Mean for western section	3.2	2.6	3.0	9.3	6.7	5.4	5.0	5.9	1.6	1.8	1.4	1.6	48.0
Mean for northwestern section	4.2	7.0	8.4	7.8	9.0	8.6	7.0	9.9	1.8	3.1	2.6	2.1	71.5
Mean for the state	4.2	3.8	5.1	5.9	8.0	8.0	5.5	8.0	3.0	3.5	2.2	1.1	58.3

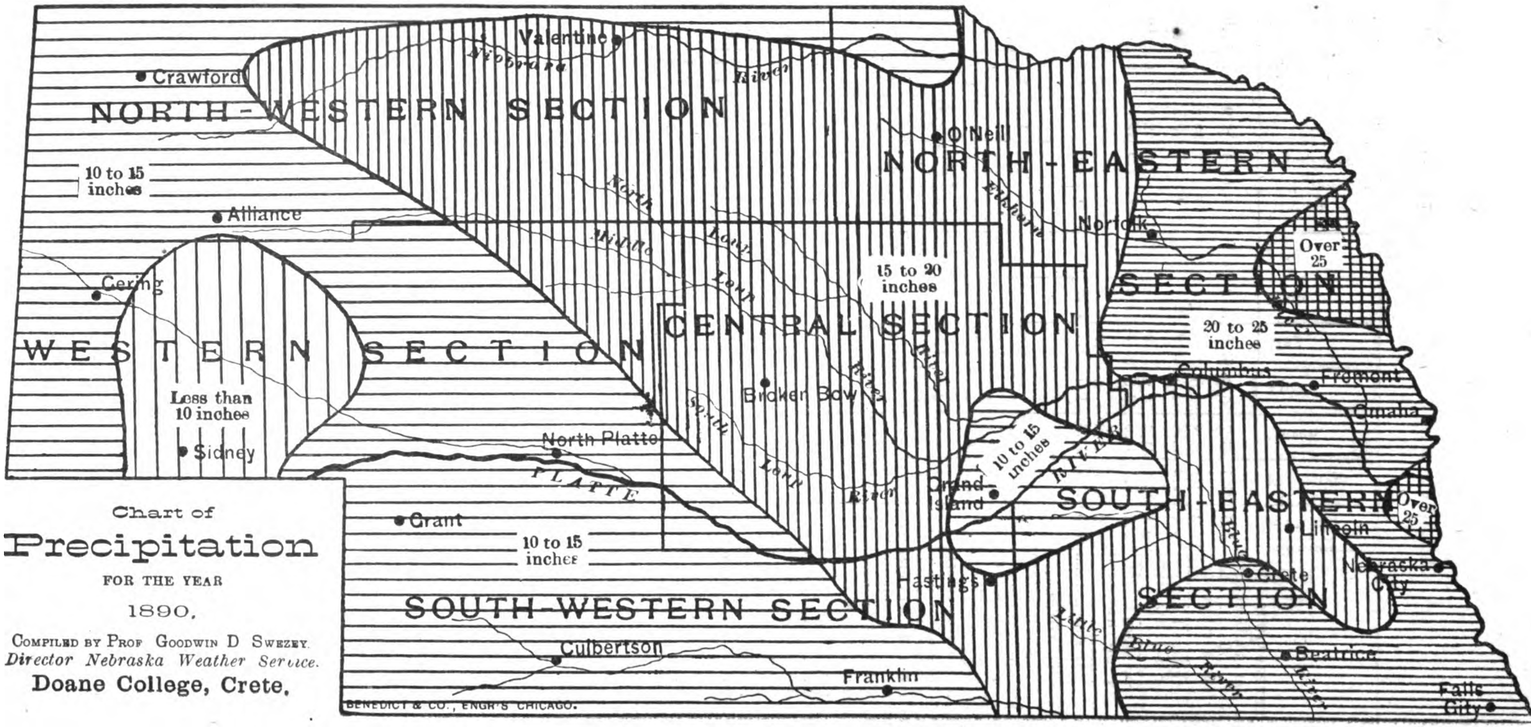


Chart of
Precipitation
FOR THE YEAR
1890.
Compiled by Prof Goodwin D Swezey.
Director Nebraska Weather Service.
Doane College, Crete.
NORTH-WESTERN SECTION
NORTH-EASTERN SECTION
WESTERN SECTION
CENTRAL SECTION
SOUTH-WESTERN SECTION
SOUTH-EASTERN SECTION
10 to 15 inches
Less than 10 inches
15 to 20 inches
20 to 25 inches
Over 25
10 to 15 inches
10 to 15 inches
Over 25
Crawford
Valentine
O'Neill
Alliance
Norfolk
Cering
Sidney
North Platte
Broken Bow
Grand Island
Columbus
Fremont
Omaha
Lincoln
Crete
Nebraska City
Grant
Hastings
Culbertson
Franklin
Beatrice
Falls City
Niobrara River
Elkhorn
North Loup
Middle Loup
South Loup River
Platte
Little Blue River
BENEDICT & CO., ENGR'S CHICAGO.

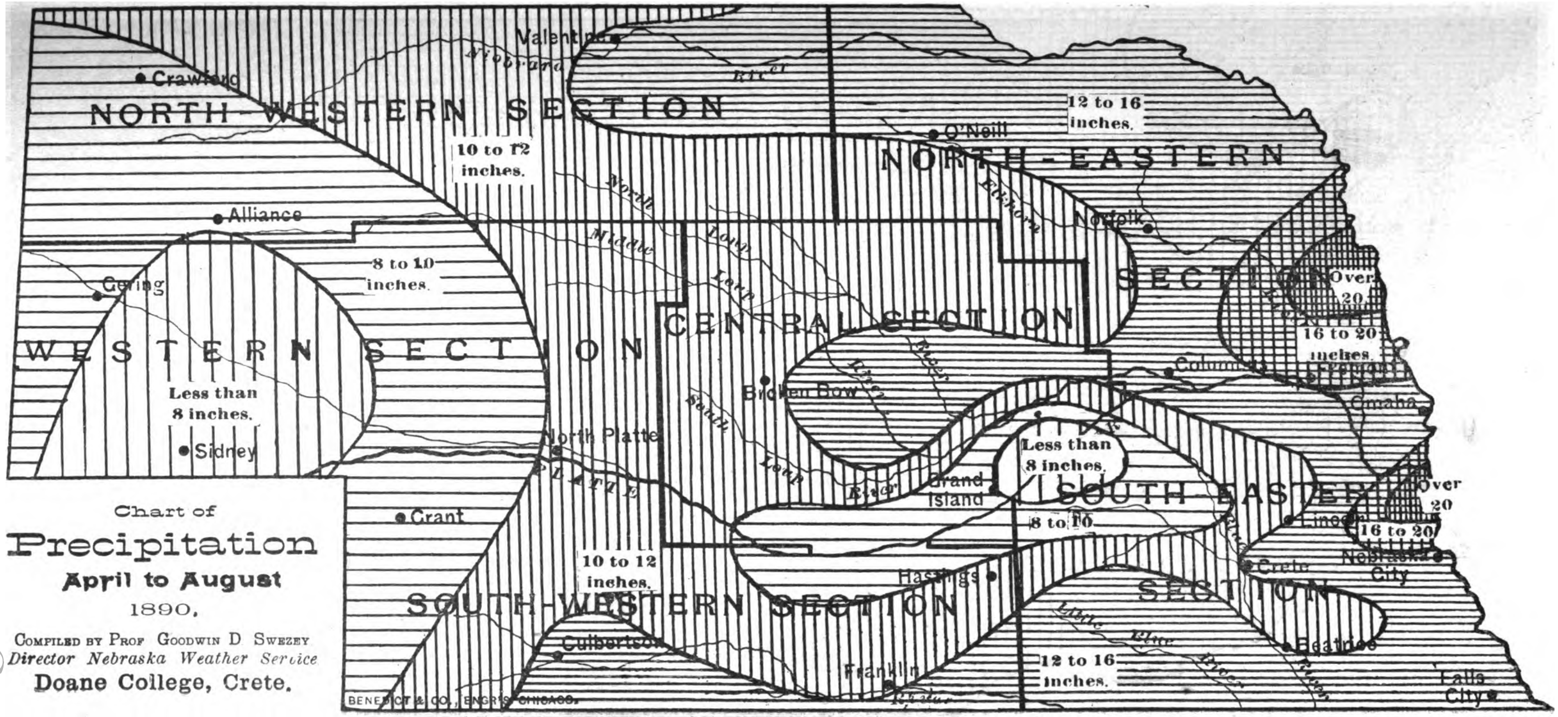
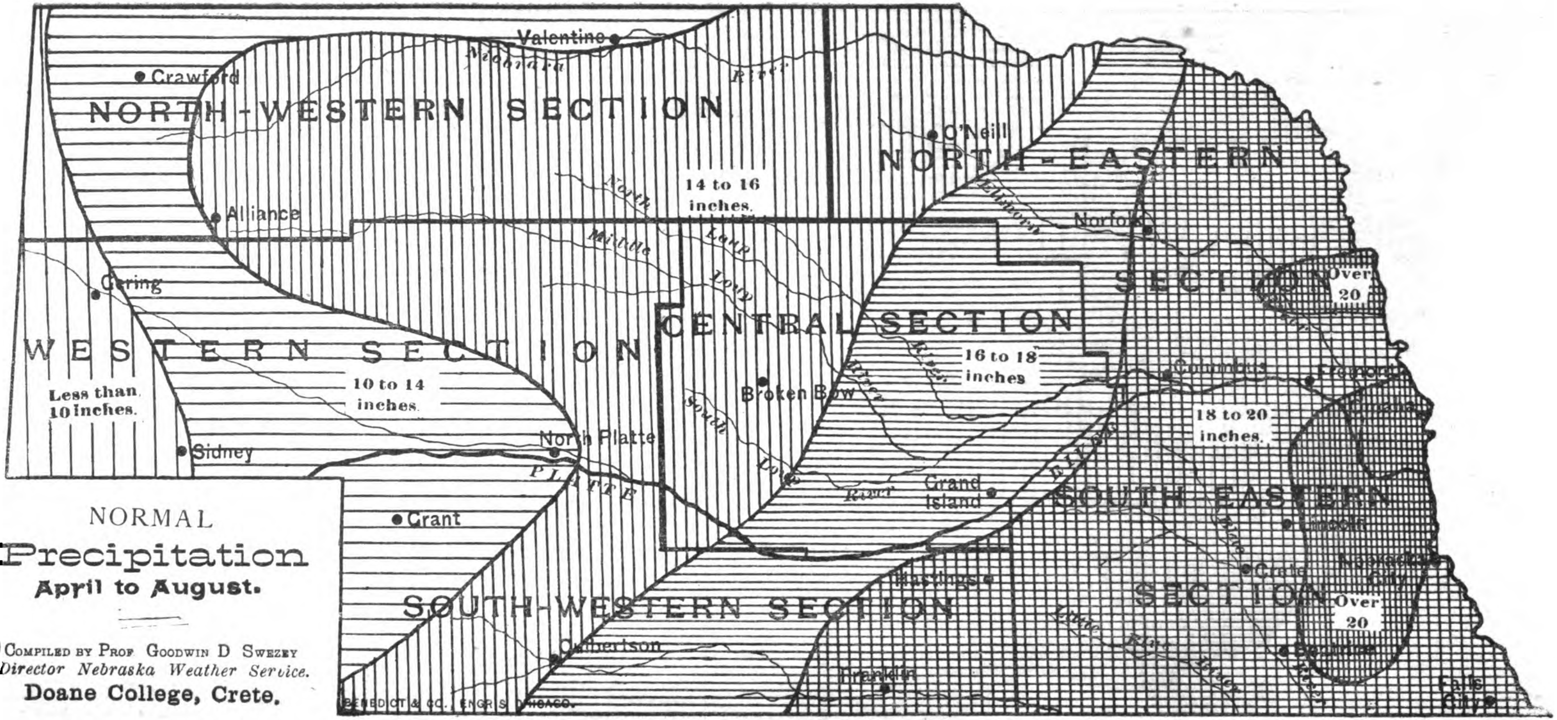


Chart of
Precipitation
April to August
1890.

Compiled by Prof Goodwin D. Swezey
Director Nebraska Weather Service
Doane College, Crete.



NORMAL

Precipitation

April to August.

Compiled by Prof. Goodwin D. Swezey
Director Nebraska Weather Service.
Doane College, Crete.

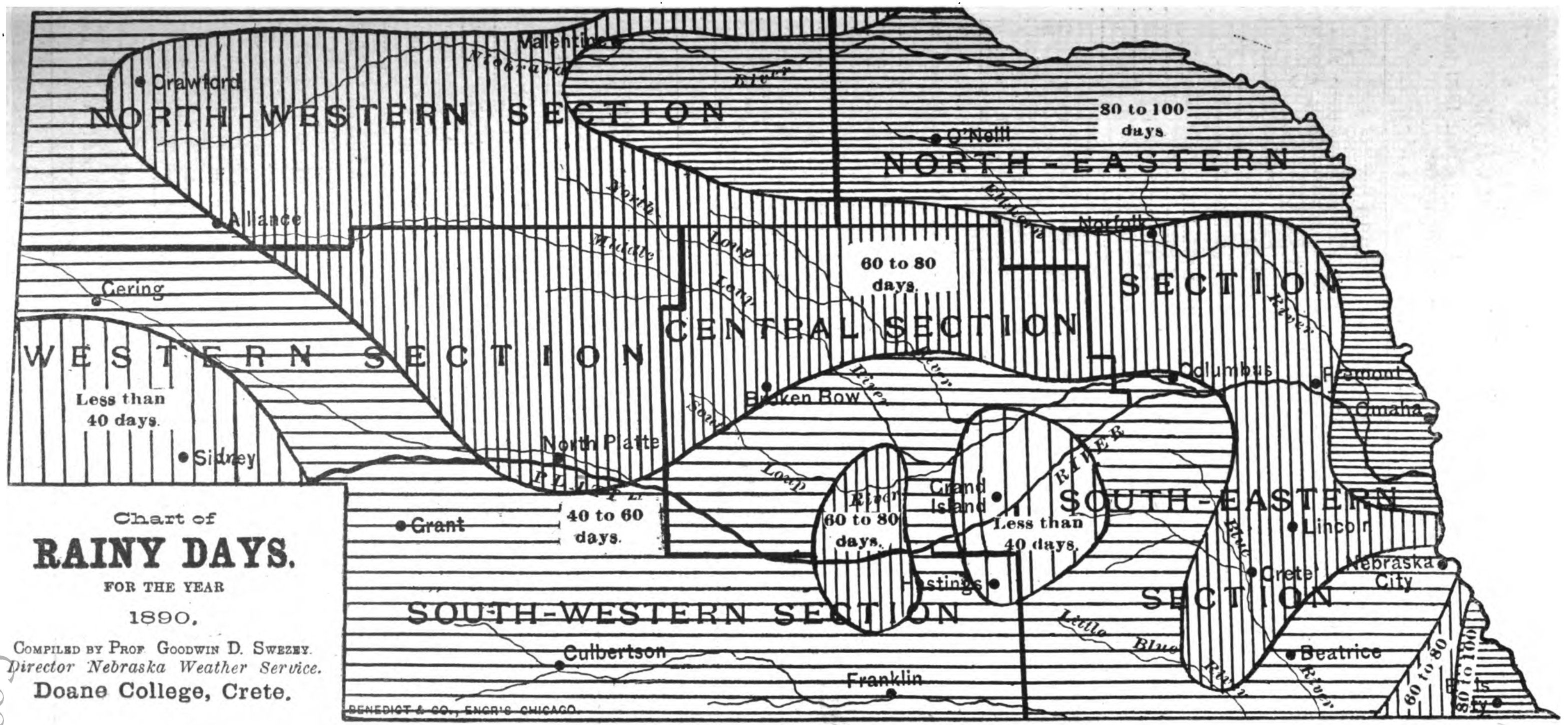


Chart of
RAINY DAYS.
FOR THE YEAR
1890.
Compiled by Prof. Goodwin D. Swezey.
Director Nebraska Weather Service.
Doane College, Crete.

UNITED STATES SIGNAL SERVICE.

Following are the monthly meteorological summaries for the year 1890, furnished by Sergt. L. A. Welsh, signal corps observer, Omaha, Nebraska:

JANUARY.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	22	29	15	....
2	6	12	1	....
3	14	30	-1	....
4	32	40	25	....
5	8	12	3	.05
6	3	8	-2	.07
7	18	29	7	....
8	34	44	23	....
9	41	52	30	....
10	37	43	31	....
11	26	38	14	.10
12	8	10	5	.55
13	3	12	-6	.21
14	18	28	7	.02
15	-3	0	-6	.22
16	-3	8	-14	....
17	8	11	4	.01
18	5	17	-7	....
19	0	4	-3	.08
20	0	6	-7	....
21	-4	1	-8	....
22	4	17	-8	.09
23	8	13	4	.04
24	20	37	2	....
25	40	45	35	....
26	38	45	30	....
27	31	40	22	....
28	34	42	26	....
29	40	48	32	....
30	44	52	37	....
31	32	36	29	....

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 30.24. Highest barometer, 30.81; date, 2d. Lowest barometer, 29.58; date, 26th. Mean temperature, 18. Highest temperature, 52; date, 9th. Lowest temperature, -14; date, 16th. Greatest daily range of temperature, 35; date, 24th. Least daily range of temperature, 5; date, 12th.

Mean temperature for this month in—

1871	24	1878	29	1885	12
1872	19	1879	22	1886	7
1873	17	1880	34	1887	12
1874	22	1881	12	1888	8
1875	11	1882	28	1889	24
1876	27	1883	12	1890	18
1877	20	1884	17		

Total deficiency in temperature during month, 68°. Total deficiency in temperature since January 1st, 68°. Prevailing direction of wind, northwest. Total movement of wind, 6,144 miles. Extreme velocity of wind, direction, and date, 32, northwest, 12th. Total precipitation, 1.44 inches. Number of days on which .01 inch or more of precipation fell, 11.

Total precipitation (in inches) for this month in—

1871	0.60	1878	1.13	1885	0.41
1872	0.08	1879	0.07	1886	1.15
1873	0.64	1880	0.90	1887	0.49
1874	0.32	1881	0.61	1888	0.58
1875	0.26	1882	0.74	1889	1.62
1876	0.22	1883	1.01	1890	1.44
1877	0.53	1884	0.72		

Total excess in precipitation during the month, 0.85. Total excess in precipitation since January 1st, 0.85. Number of cloudless days, 8; partly cloudy days, 12; cloudy days, 11. Dates of frost, ——.

FEBRUARY.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	32	41	22	....
2	42	49	34	T
3	36	37	34	....
4	48	64	32	....
5	29	32	26	....
6	28	35	22	....
7	32	43	20	.01
8	20	32	8	....
9	34	43	25	....
10	43	56	30	....
11	28	31	25	....
12	34	48	19	....
13	42	53	20	....
14	36	44	28	....
15	44	61	28	....
16	29	33	25	....
17	26	32	21	....
18	14	24	3	....
19	16	22	9	.02
20	2	11	-8	....
21	12	18	5	.04
22	22	28	16	.14
23	32	43	22	....
24	31	36	26	....
25	2	6	-1	.17
26	0	6	-7	.06
27	-2	1	-6	.08
28	-1	10	-12	.02

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 30.15. Highest barometer, 30.72; date, 21st. Lowest barometer, 29.58; date, 23d. Mean temperature, 25. Highest temperature, 64; date, 4th. Lowest temperature, -12; date, 28th. Greatest daily range of temperature, 33; date, 15th. Least daily range of temperature, 3; date, 3d.

Mean temperature for this month in—

1871	30	1878	37	1885	17
1872	28	1879	27	1886	24
1873	27	1880	31	1887	18
1874	23	1881	18	1888	26
1875	18	1882	36	1889	23
1876	30	1883	22	1890	25
1877	37	1884	19		

Total deficiency in temperature during month, 27°. Total deficiency in temperature since January 1st, 95°. Prevailing direction of wind, northwest. Total movement of wind, 6,367 miles. Extreme velocity of wind, direction, and date, 38, northwest, 7th. Total precipitation, 0.54 inches. Number of days on which .01 inch or more of precipitation fell, 8.

Total precipitation (in inches) for this month in—

1871	1.76	1878	0.14	1884	1.42
1872	0.43	1879	0.93	1885	0.47
1873	0.04	1880	0.14	1886	0.36
1874	0.92	1881	3.09	1887	1.00
1875	0.51	1882	0.60	1888	0.74
1876	0.40	1883	1.09	1889	0.23
1877	0.44				

Total deficiency in precipitation during month, 0.24. Total excess in precipitation since January 1st, 0.61. Number of cloudless days, 8; partly cloudy days, 8; cloudy days, 12. Dates of frost, ——.

MARCH.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	6	12	1	....
2	22	40	4	....
3	36	49	23	....
4	14	18	10	.03
5	14	18	9	.10
6	10	16	4	.28
7	21	26	16	T
8	22	31	13	....
9	30	34	27	.06
10	37	41	33	.02
11	40	45	34	T
12	37	44	30	....
13	37	48	26	....
14	21	29	13	.01
15	12	24	1	....
16	34	51	18	....
17	47	57	37	....
18	45	53	37	....
19	36	45	26	....
20	50	62	39	....
21	50	65	35	....
22	40	51	30	.03
23	42	54	30	....
24	54	64	43	....
25	46	53	38	....
26	42	55	29	....
27	36	44	29	.72
28	34	48	20	....
29	36	40	32	....
30	30	34	27	....
31	31	37	25	.10

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 30.14. Highest barometer, 30.74; date, 15th. Lowest barometer, 29.36; date, 27th. Mean temperature, 33. Highest temperature, 65; date, 21st. Lowest temperature, 1; date, 15th. Greatest daily range of temperature, 36; date, 2d. Least daily range of temperature, 7; date, 9th.

Mean temperature for this month in—

1871	41	1878	48	1885	36
1872	31	1879	41	1886	32
1873	38	1880	36	1887	38
1874	34	1881	28	1888	29
1875	30	1882	40	1889	40
1876	29	1883	35	1890	33
1877	34	1884	35		

Total deficiency in temperature during month, 92°. Total deficiency in temperature since January 1st, 187°. Prevailing direction of wind, north, 34 per cent. Total movement of wind, 7,787 miles. Extreme velocity of wind, direction, and date, 50 miles on the 27th. Total precipitation, 1.35 inches. Number of days on which .01 inch or more of precipitation fell, 10.

Total precipitation (in inches) for this month in—

1871	0.18	1878	3.09	1885	0.33
1872	1.61	1879	2.17	1886	1.81
1873	0.44	1880	0.50	1887	0.48
1874	1.49	1881	0.72	1888	3.25
1875	1.24	1882	0.79	1889	0.53
1876	3.18	1883	0.52	1890	1.35
1877	1.26	1884	4.91		

Total deficiency in precipitation during month, 0.14. Total excess in precipitation since January 1st, 0.47. Number of cloudless days, 6; partly cloudy days, 11; cloudy days, 14. Dates of frost, ——.

APRIL.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	34	44	23	....
2	40	44	36	.05
3	49	56	42	1.06
4	48	59	38	.02
5	55	65	45	....
6	66	78	53	....
7	66	86	46	....
8	60	68	52	....
9	42	51	33	.33
10	56	76	36	....
11	69	86	52	....
12	53	63	43	....
13	49	56	42	....
14	48	56	40	....
15	52	61	43	....
16	52	60	45	....
17	53	66	40	T
18	57	71	43	....
19	60	72	49	....
20	60	70	49	....
21	62	72	51	....
22	64	73	56	.03
23	53	58	48	....
24	52	63	40	....
25	50	55	44	....
26	54	65	44	.06
27	58	72	45	....
28	62	74	51	....
29	61	76	46	....
30	70	81	58	....

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 30.06. Highest barometer, 30.56; date, 1st. Lowest barometer, 29.46; date, 11th. Mean temperature, 55. Highest temperature, 86; date, 11th. Lowest temperature, 23; date, 1st. Greatest daily range of temperature, 40; date, 10th. Least daily range of temperature, 8; date, 2d.

Mean temperature for this month in—

1871	54	1878	55	1885	50
1872	51	1879	54	1886	51
1873	45	1880	51	1887	54
1874	45	1881	44	1888	52
1875	45	1882	52	1889	52
1876	51	1883	54	1890	55
1877	50	1884	48		

Total excess in temperature during month, 166°. Total deficiency in temperature since January 1st, 21°. Prevailing direction of wind, southeast. Total movement of wind, 7,340 miles. Extreme velocity of wind, direction, date, 36, northwest, on the 8th. Total precipitation, 1.55 inches. Number of days on which .01 inch or more of precipitation fell, 6.

Total precipitation (in inches) for this month in—

1871	3.38	1878	3.97	1885	6.34
1872	3.84	1879	1.77	1886	1.77
1873	3.83	1880	0.55	1887	0.88
1874	2.01	1881	4.23	1888	2.95
1875	3.06	1882	4.31	1889	1.19
1876	2.65	1883	3.20	1890	1.55
1877	6.24	1884	3.88		

Total deficiency in precipitation during month, 1.90. Total deficiency in precipitation since January 1st, 1.43. Number of cloudless days, 10; partly cloudy days, 13; cloudy days, ——. Dates of frost, ——.

MAY.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	54	67	41	....
2	64	80	47	....
3	62	72	52	....
4	46	50	41	.02
5	42	52	33	....
6	44	51	36	.17
7	49	63	35	.01
8	64	80	47	....
9	68	82	53	.51
10	54	64	46	.03
11	60	74	45	....
12	58	68	47	.15
13	50	61	38	....
14	52	80	44	....
15	58	60	46	....
16	60	78	41	.08
17	60	74	46	T
18	60	70	50	....
19	57	65	47	.18
20	57	62	52	....
21	60	70	51	....
22	64	74	54	.52
23	66	77	54	....
24	63	70	56	.51
25	60	70	51	T
26	60	71	48	....
27	70	84	55	....
28	78	88	68	....
29	78	89	68	....
30	72	77	67	.38
31	72	81	64	.16

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 29.91. Highest barometer, 30.27; date, 7th. Lowest barometer, 29.54; date, 9th. Mean temperature, 60. Highest temperature, 89; date, 29th. Lowest temperature, 33; date, 5th. Greatest daily range of temperature, 37; date, 16th. Least daily range of temperature, 9; date, 4th.

Mean temperature for this month in—

1871	63	1878	58	1885	60
1872	61	1879	67	1886	65
1873	59	1880	69	1887	66
1874	66	1881	68	1888	56
1875	63	1882	57	1889	62
1876	63	1883	57	1890	60
1877	60	1884	62		

Total deficiency in temperature during month, 63°. Total deficiency in temperature since January 1st, 84°. Prevailing direction of wind, northwest, 26 per cent. Total movement of wind, 7,730 miles. Extreme velocity of wind, direction, and date, 50 miles, 22d. Total precipitation, 2.72 inches. Number of days on which .01 inch or more of precipitation fell, 12.

Total precipitation (in inches) for this month in—

1871	1.83	1878	5.77	1885	4.48
1872	6.35	1879	5.53	1886	4.58
1873	5.59	1880	3.40	1887	1.39
1874	1.24	1881	7.94	1888	4.36
1875	4.25	1882	4.91	1889	2.67
1876	2.07	1883	11.29	1890	2.72
1877	8.62	1884	1.45		

Total deficiency in precipitation during month, 2.24. Total deficiency in precipitation since January 1st, 3.67. Number of cloudless days, 7; partly cloudy days, 18; cloudy days, 6. Dates of frost, killing on the 7th. Mean dew point, 42.8. Mean humidity, 58.4.

JUNE.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	72	81	63	.06
2	78	87	69	T
3	70	80	59	1.85
4	68	76	61	.06
5	62	67	58	.01
6	62	71	52	....
7	64	76	52	....
8	66	77	56	....
9	63	69	57	.03
10	66	78	54	....
11	74	86	61	....
12	76	88	63	.01
13	62	90	73	....
14	70	77	62	.36
15	70	82	58	....
16	71	87	60	.56
17	77	86	68	....
18	80	93	68	....
19	70	74	66	.24
20	78	90	67	....
21	79	91	67	....
22	80	91	70	....
23	79	94	64	1.10
24	84	96	72	....
25	84	94	73	....
26	86	96	75	....
27	86	98	74	....
28	96	97	74	....
29	76	84	67	.67
30	74	83	65	.09

NOTE—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 29.91. Highest barometer, 30.30; date, 8th. Lowest barometer, 29.57; date, 3d. Mean temperature, 74. Highest temperature, 98; date, 27. Lowest temperature, 52; date, 7th. Greatest daily range of temperature, 30; date, 23d. Least daily range of temperature, 8; date, 19th.

Mean temperature for this month in—

1871	75.8	1878	66.7	1885	71.1
1872	72.8	1879	72.7	1886	71.2
1873	74.1	1880	73 0	1887	72.4
1874	73.1	1881	74.9	1888	70.0
1875	70.9	1882	71.0	1889	68.7
1876	68.2	1883	69.1	1890	7.44
1877	69.1	1884	72.3		

Total excess in temperature during month, 81°. Total deficiency in temperature since January 1st, 3°. Prevailing direction of wind, south. Total movement of wind, 6,029 miles. Extreme velocity of wind, direction, and date, 38 miles, east, on 22d. Total precipitation, 5.04 inches. Number of days on which .01 inch or more of precipitation fell, 12.

Total precipitation (in inches) for this month in—

1871	2.65	1878	8.48	1885	2.67
1872	3.91	1879	4.09	1886	1.50
1873	5.86	1880	3.14	1887	4.56
1874	6.93	1881	5.56	1888	3.86
1875	10.95	1882	12.05	1889	5.44
1876	3.47	1883	12.70	1890	5.04
1877	8.36	1884	6.11		

Total deficiency in precipitation during the month, 1.11. Total deficiency in precipitation since January 1st, 4.78. Number of cloudless days, 10; partly cloudy days, 13; cloudy days, 7. Dates of frost, none.

JULY.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	76	86	67	....
2	76	86	65	....
3	74	80	68	....
4	67	79	55	....
5	78	93	63	....
6	88	99	76	....
7	90	102	77	....
8	77	86	68	.10
9	78	92	64	....
10	83	94	72	....
11	82	90	78	.01
12	82	92	72	.17
13	89	105	73	....
14	81	90	72	....
15	76	85	66	.30
16	81	93	69	....
17	86	93	78	....
18	78	85	70	....
19	68	74	63	2.97
20	74	80	68	.02
21	72	80	65	.16
22	76	82	69	.01
23	78	86	70	....
24	72	79	65	....
25	73	84	62	....
26	76	89	63	....
27	79	90	68	....
28	82	93	72	....
29	84	96	72	....
30	88	100	77	....
31	78	86	71	....

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 29.976. Highest barometer, 30.190; date, 15th. Lowest barometer, 29.711; date, 13th. Mean temperature, 78.8. Highest temperature, 105.; date, 13th. Lowest temperature, 55.2; date, 4th. Greatest daily range of temperature, 32°; date, 5th. Least daily range of temperature, 11; date, 19th.

Mean temperature for this month in—

1871	75.4	1878	79.0	1885	77.0
1872	76.1	1879	78.5	1886	77.3
1873	74.5	1880	76.7	1887	76.3
1874	79.6	1881	78.9	1888	77.6
1875	74.2	1882	71.7	1889	74.8
1876	75.2	1883	75.7	1890	78.8
1877	75.6	1884	74.5		

Total excess in temperature during month, +82°. Total deficiency in temperature since January 1, 79°. Prevailing direction of wind, south. Total movement of wind, 6,331 miles. Extreme velocity of wind, direction, and date, 28, south, 28th. Total precipitation, 3.74 inches. Number of days on which .01 inch or more of precipitation fell, 8.

Total precipitation (in inches) for this month in—

1871	9.89	1878	7.66	1885	9.24
1872	6.36	1879	3.17	1886	0.69
1873	4.24	1880	5.36	1887	2.02
1874	0.54	1881	5.89	1888	2.56
1875	10.01	1882	6.76	1889	4.94
1876	7.30	1883	4.79	1890	3.74
1877	0.96	1884	10.35		

Total deficiency in precipitation during month, -2.09. Total deficiency in precipitation since January 1st, -6.87. Number of cloudless days, 16; partly cloudy days, 10; cloudy days, 5. Dates of frost, ——.

AUGUST.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	80	94	66	.02
2	86	99	74	.08
3	81	91	71	....
4	70	78	62	....
5	71	84	58	....
6	80	93	66	T
7	82	95	70	....
8	80	66	73	....
9	70	78	62	....
10	70	81	58	....
11	68	75	60	....
12	66	73	60	.25
13	76	86	65	.01
14	74	86	63	....
15	77	86	68	....
16	68	76	60	.05
17	62	75	48	....
18	68	77	58	....
19	63	71	54	.10
20	61	66	56	.06
21	68	84	52	T
22	60	72	49	....
23	64	68	60	.41
24	68	74	63	.02
25	70	83	57	.01
26	70	79	61	.01
27	70	83	56	....
28	74	82	65	....
29	66	75	56	....
30	69	82	56	....
31	74	86	62	....

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 30.05. Highest barometer, 30.33, date 22d. Lowest barometer, 29.82; date, 1st. Mean temperature, 70.5. Highest temperature, 99; date, 2d. Lowest temperature, 48; date, 17th. Greatest daily range of temperature, 32; date, 21st. Least daily range of temperature, 8; date, 23d.

Mean temperature for this month in—

1871	74	1878	77	1884	70
1872	75	1879	75	1885	76
1873	77	1880	75	1886	72
1874	77	1881	80	1887	70
1875	70	1882	73	1888	71
1876	75	1883	71	1889	74
1877	73				

Total deficiency in temperature during month, 87°. Total deficiency in temperature since January 1st, 8°. Prevailing direction of wind, south. Total movement of wind, 5,081 miles. Extreme velocity of wind, direction, and date, 28, southeast, 3d. Total precipitation, 1.02 inches. Number of days on which .01 inch or more of precipitation fell, 11.

Total precipitation (in inches) for this month in—

1871	2.58	1878	2.48	1884	7.07
1872	1.78	1879	1.51	1885	4.53
1873	1.60	1880	7.10	1886	2.53
1874	2.08	1881	1.65	1887	3.94
1875	7.77	1882	0.95	1888	3.44
1876	6.27	1883	3.39	1889	2.90
1877	3.13				

Total deficiency in precipitation during month, 2.51. Total deficiency in precipitation since January 1st, 9.38. Number of cloudless days, 7; partly cloudy days, 18; cloudy days, 5. Dates of frost, none.

SEPTEMBER.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	78	88	69	....
2	82	91	71	.01
3	76	83	69	.17
4	68	74	61	.21
5	70	79	62	....
6	84	93	74	....
7	54	58	50	.36
8	58	72	45	....
9	60	73	48	....
10	64	76	53	....
11	66	75	58	....
12	50	55	46	.33
13	51	66	36	....
14	58	68	47	....
15	66	77	54	....
16	57	72	42	....
17	72	88	57	....
18	69	75	63	1.41
19	52	62	42	....
20	58	68	47	....
21	61	71	51	....
22	58	72	43	....
23	62	71	52	....
24	59	66	52	....
25	60	67	53	....
26	65	76	54	.01
27	58	66	50	....
28	54	66	41	....
29	54	69	40	....
30	57	71	43	....

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 30.10. Highest barometer, 30.51; date, 28th. Lowest barometer, 29.63; date, 6th. Mean temperature, 62.7. Highest temperature, 94; date, 2d. Lowest temperature, 36; date, 13th. Greatest daily range of temperature, 31; date, 17th. Least daily range of temperature, 8; date, 7th.

Mean temperature for this month in—

1871..........62	1878..........64	1885..........64
1872..........62	1879..........62	1886..........66
1873..........60	1880..........68	1887..........65
1874..........68	1881..........66	1888..........61
1875..........62	1882..........68	1889..........64
1876..........62	1883..........61	1890..........63
1877..........66	1884..........69	

Total deficiency in temperature during month, 27°. Total deficiency in temperature since January 1st, 35°. Prevailing direction of wind, south. Total movement of wind, 5,061 miles. Extreme velocity of wind, direction, and date, 34, northwest, 18th. Total precipitation, 2.50 inches. Number of days on which .01 inch or more of precipitation fell, 7.

Total precipitation (in inches) for this month in—

1871..........2.73	1878..........3.22	1885..........2.50
1872..........3.24	1879..........1.43	1886..........4.45
1873..........1.86	1880..........2.91	1887..........2.44
1874..........7.18	1881..........3.36	1888..........0 24
1875..........2.55	1882..........0.51	1889..........1.74
1876..........4.93	1883..........4.53	1890..........2.50
1877..........2.05	1884..........4.91	

Total deficiency in precipitation during month, 1.07. Total deficiency in precipitation since January 1st, 10.45. Number of cloudless days, 11; partly cloudy days, 13; cloudy days, 6. Dates of frost, 13th, 28th, 29th.

OCTOBER.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	57	67	47	....
2	60	71	48	....
3	62	65	60	T
4	58	69	48	....
5	50	60	51	.10
6	50	63	38	....
7	53	65	41	....
8	61	67	55	.17
9	54	59	50	.19
10	48	53	43	....
11	63	76	50	.25
12	67	76	58	.01
13	48	51	46	.31
14	52	67	38	....
15	48	54	43	.02
16	52	67	37	....
17	57	72	42	....
18	50	58	41	....
19	50	66	35	....
20	53	64	42	....
21	50	61	39	....
22	51	62	40	....
23	53	64	42	....
24	50	61	38	....
25	48	58	38	....
26	40	48	32	....
27	48	63	32	....
28	54	71	37	....
29	41	44	38	.02
30	40	45	34	.02
31	43	60	26	....

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 30.01. Highest barometer, 30.45; date, 26th. Lowest barometer, 29.59; date, 13th. Mean temperature, 52. Highest temperature, 76; date, 12th. Lowest temperature, 26; date, 31st. Greatest daily range of temperatuce, 34; date, 31st. Least daily range of temperature, 5; date, 3d, 13th.

Mean temperature for this month in—

1871..........53	1878..........52	1885..........50
1872..........53	1879..........62	1886..........58
1873..........48	1880..........49	1887..........51
1874..........54	1881..........54	1888..........48
1875..........50	1882..........57	1880..........52
1876..........50	1883..........49	1890..........52
1877..........51	1884..........57	

Total deficiency in temperature during month, 16°. Total deficiency in temperature since January 1st, 51°. Prevailing direction of wind, south. Total movement of wind, 5,654 miles. Extreme velocity of wind, direction, and date, 36, northwest, 18th. Total precipitation, 1.09 inches. Number of days on which .01 inch or more of precipitation fell, 9.

Total precipitation (in inches) for this month in—

1871..........2.06	1878..........0.55	1885..........3.86
1872..........3.89	1879..........3.64	1886..........1.33
1873..........1.82	1880..........3.54	1887..........0.72
1874..........1.45	1881..........4.84	1888..........1.16
1875..........1.16	1882..........3.09	1889..........0.34
1876..........0.69	1883..........5.03	1890..........1.09
1877..........5.86	1884..........5.81	

Total deficiency in precipitation during month, 1.95. Total deficiency in precipitation since January 1st, 12.40. Number of cloudless days, 12; partly cloudy days, 9; cloudy days, 10. Dates of frost, 6th, 17th, 19th, 26th, 27th, 30th.

NOVEMBER.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	57	68	46	T
2	34	36	33	T
3	45	64	26	....
4	48	59	37	....
5	52	62	42	....
6	40	49	31	....
7	26	32	20	....
8	30	34	26	.64
9	25	30	20	T
10	26	32	21	....
11	42	56	28	....
12	40	48	31	....
13	46	58	34	....
14	46	54	38	....
15	41	46	36	....
16	37	42	32	.01
17	47	56	38	.36
18	50	61	39	....
19	49	62	36	....
20	56	70	42	....
21	50	56	43	....
22	40	52	28	....
23	46	59	33	....
24	47	60	34	T
25	38	47	30	....
26	38	55	22	....
27	42	52	31	....
28	40	47	33	....
29	42	56	29	....
30	43	60	26	....

NOTE—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 30.17. Highest barometer, 30.69; date, 22d. Lowest barometer, 29.64; date, 5th. Mean temperature, 42. Highest temperature, 70; date, 20th. Lowest temperature, 20; date, 9th. Greatest daily range of temperature, 38; date, 3d. Least daily range of temperature, 3; date, 2d.

Mean temperature for this month in—

1871	31	1878	44	1884	39
1872	30	1879	40	1885	40
1873	38	1880	26	1886	34
1874	36	1881	37	1887	40
1875	33	1882	40	1888	37
1876	33	1883	39	1889	36
1877	36				

Total excess in temperature during month, 175°. Total excess in temperature since January 1st, 124°. Prevailing direction of wind, north. Total movement of wind, 4,749 miles. Extreme velocity of wind, direction, and date, 28, northwest, 1st. Total precipitation, 1.01 inches. Number of days on which .01 inch or more of precipitation fell, 3.

Total precipitation (in inches) for this month in—

1871	4.22	1878	0.29	1885	0.73
1872	0.84	1879	4.25	1886	1.54
1873	0.19	1880	0.70	1887	0.89
1874	1.05	1881	1.29	1888	0.12
1875	0.13	1882	0.05	1889	0.87
1876	1.17	1883	0.64	1890	1.01
1877	1.36	1884	0.32		

Total deficiency in precipitation during month, 31. Total deficiency in precipitation since January 1st, 12.71. Number of cloudless days, 16; partly cloudy days, 7; cloudy days, 7. Dates of frost, ——.

DECEMBER.

Date.	Temperature. Mean.	Max.	Min.	Precip. in inches & 100ths
1	31	36	26	....
2	24	26	21	T
3	23	30	16	....
4	24	30	16	T
5	23	27	19	....
6	22	28	17	....
7	14	24	5	....
8	25	40	10	....
9	47	64	30	....
10	55	74	39	....
11	38	47	30	....
12	26	36	16	....
13	40	54	27	....
14	38	47	28	....
15	43	54	32	....
16	36	44	29	....
17	36	50	23	....
18	40	53	28	....
19	41	54	28	....
20	43	51	35	....
21	40	53	28	....
22	49	60	38	....
23	30	34	25	....
24	25	30	20	....
25	22	33	11	....
26	38	55	22	....
27	32	43	20	....
28	44	61	27	....
29	40	52	29	....
30	38	46	31	....
31	42	46	38	.08

NOTE.—Barometer reduced to sea level. "T" indicates trace of precipitation.

SUMMARY.

Mean barometer, 30.18. Highest barometer, 30.67; date, 12th. Lowest barometer, 29.62; date, 31st. Mean temperature, 35. Highest temperature, 74; date, 10th. Lowest temperature, 5; date, 7th. Greatest daily range of temperature, 34; date, 9th. Least daily range of temperature, 5; date, 2d.

Mean temperature for this month in—

1871	18	1878	22	1885	29
1872	18	1879	17	1886	18
1873	25	1880	18	1887	24
1874	28	1881	36	1888	30
1875	34	1882	25	1889	39
1876	19	1883	29	1890	35
1877	39	1884	17		

Total excess in temperature during month, 2.99. Total excess in temperature since January 1st, 4.22. Prevailing direction of wind, south. Total movement of wind, 5,351 miles. Extreme velocity of wind, direction, and date, 36, northwest, 26th. Total precipitation, .08 inches. Number of days on which .01 inch or more of precipitation fell, 1.

Total precipitation (in inches) for this month in—

1871	0.91	1878	0.27	1885	1.17
1872	0.12	1879	1.75	1886	1.46
1873	0.93	1880	0.28	1887	1.11
1874	0.54	1881	1.56	1888	0.96
1875	1.00	1882	0.92	1889	0.50
1876	0.16	1883	0.73	1890	0.08
1877	2.14	1884	0.72		

Total deficiency in precipitation during month, 94. Total deficiency in precipitation since January 1st, 13.65. Number of cloudless days, 14; partly cloudy days, 11; cloudy days, 6. Dates of frost, ——.

A DOZEN GRASSES AND CLOVERS FOR NEBRASKA.

BY CHARLES E. BESSEY.

I propose, in this paper, to restrict myself to the discussion of a dozen of the more prominent grasses and clovers which occur in Nebraska, either in the wild or cultivated state. These which I have selected may not be the twelve most important, and, in fact, I am quite certain that for some parts of the state some of these which I have included should be dropped, while others should be included. But perhaps the selection which I have made may be allowed, all things considered, as including those which are of the most general interest in the state.

TIMOTHY.

This grass, which is indigenous to England, nearly the whole of Europe, parts of Africa, parts of Asia, and a large part of North America, was first introduced into cultivation in this country. It has not been long known as a cultivated grass, but its use has spread very rapidly throughout both this country and Europe. It is now so common that it is difficult to realize that a hundred years ago it was scarcely used as field grass. If we examine with care the structure and composition of timothy, we find very good reasons for the great favor in which it is held by the farmer. It produces its seeds in great quantity, and these can be easily harvested and cleaned. These same seeds germinate very easily, and so it is not a difficult matter to secure a good stand in the new meadow. It is adapted to a variety of soils, although flourishing best where there is a fair amount of moisture. It is perfectly hardy, and as a consequence can be grown where the winters are very severe. Upon rich soils it attains a height rarely excelled by any other grass, and it produces a large quantity of palatable leaves borne upon a stem which is rarely too coarse or too heavy for good hay. Moreover, it is very easily cut and made into hay. It rarely moulds, and under reasonable treatment will invariably make a first-class fodder.

Chemically, timothy is shown to be quite nutritious, although not as rich in nutritive substances as some of the other forage plants. According to Dr. Stebler, ordinary timothy hay contains 81 per cent of organic matter, divided as follows:

Albumen, $9\frac{1}{2}$ per cent, of which nearly 6 per cent may be assimilated.
Fibre, $22\frac{1}{2}$ per cent, } of which about 43 per cent may be
Non-nitrogenous substances, 46 per cent, } assimilated.
Fat, 3 per cent, of which $1\frac{1}{2}$ per cent may be assimilated.

Stebler remarks that "from these analyses it is seen that the proportion of albumen is lower, and that of starch, sugar, etc., higher than in any other fodder plants. By itself, then, it is not a profitable fodder. It is best mixed with clover, or other plants rich in albumen."

It has long been the practice of farmers in this country to mix clover with timothy, and this practice is shown by the preceding figures to be an excellent one, as thereby the deficiency in albumen is made good by the clover.

A matter which has received very little attention in this part of the country, and yet which is of much importance, is the purity of the seed. Many of our grasses are harvested for their seed at a time when the fields have a greater or less number of weeds in them. These weeds furnish a varying amount of seed, which, in many cases, is permitted to remain with the grass seed. In the case of timothy this evil is occasionally very serious, but it is to the credit of American farmers that in the markets of the world American timothy seed is considered to be, usually, much purer than that grown in Europe. The timothy brought to us from the eastern states is likely to have in it the seeds of the narrow plantain (*Plantago lanceolata*) and the ox-eye daisy (*Chrysanthemum leucanthemum*), both of which are likely to become troublesome pests in the west. We may hope that the Nebraska farmers will take pains to see that the seeds of the grasses which they sow are reasonably free from weed seeds, especially of the seeds of these two very troublesome weeds.

KENTUCKY BLUE GRASS.

I have repeatedly before this society described and discussed this grass, and I need not stop now to do more than to make some general suggestions regarding it. It is also a native of Europe, Asia, and North America. It is said to occur in Australia in a wild state. Under cultivation it is now found in almost every place, and it has run into many marked varieties. Some of these varieties are large and fine, while others are small and of poor quality. The finest variety is that which has been very generally called Kentucky blue grass, because of the fact that in the pastures of the rich soil of Kentucky it occurs in perfection. However, I have seen in Nebraska and Iowa as fine specimens of this grass as occur anywhere in the world.

In order to grow Kentucky blue grass to perfection, the soil must be rich. It must have a considerable quantity of moisture, but must not be wet. Upon dry and thin soils it never does well, especially if there is a deficiency in the amount of organic matter present in the soil.

As a pasture grass, few of the grasses grown upon the farm are superior to this. It is rich in those constituents which are desirable in the food of animals, and the stems are rarely so large or so hard as to render them inedible. When properly fed, the meadows of blue grass yield large quantities of most valuable food. The bottom lands of this state, and even the moister high lands, are admirably adapted to this grass, which has already spread throughout nearly the whole of the state. While it is affected by drouth quite seriously, so that during the summer months it is frequently of little value for pasture, yet upon the return of the rains in the fall it springs up quickly, and for a long time furnishes good pasturage.

Blue grass seed is not often adulterated or contaminated by weed seeds, but the more common difficulty is that the seed is not in good condition for germination. The structure of the seed is such that if allowed to remain in a large mass, as in a pile or bin, it is apt to become mouldy, and this injures the vitality of the seed.

I have known of cases, too, where the seeds of other grasses were substituted in place of blue grass. This difficulty, however, is one which may be easily obviated by a little care in examining the seed. Blue grass seed is always more or less covered with small, white hairs, and by these the seed of this grass may be readily told from that of any other.

RED TOP.

The third important cultivated grass which may be mentioned is what is known throughout a large portion of the country as red top. In many places it also bears the name of "Herd's grass," and in some places has been known under the name of "Fiorin." It occurs in a wild state throughout the greater part of Europe, parts of Africa, Asia, and North America, and perhaps it is on this account that it is so widely used under cultivation. It is important that the grass under consideration should not be mistaken for other kinds which have sometimes been called red top. This grass of which I am now speaking is one which grows to a moderate height, say from two to three or three and one-half feet, and it bears a branching head of very fine and delicate flowers. The delicate branches of the head bear reddish colored flowers, which give to the whole a reddish cast, from which the common name is derived. There are a number of wild grasses to which the name red top has been applied, but these are all much coarser than the one under consideration.

Red top has been introduced into this state to a considerable extent, and I find that every year the grass samples which are brought to the State Fair show more and more of this grass. Judging from the specimens placed on exhibition, there can be no question but that red top grows to perfection in many portions of the state. It prefers a soil which is quite moist, and is therefore well suited to the lower lands adjoining the rivers and creeks, and I have no doubt that in the central parts of the state, where there are so many small lakes, that it would succeed well near to these.

Red top has long been known favorably as furnishing a valuable hay, especially for horses. It is somewhat apt to become "musty" if care is not taken in the making of the hay, but if this is avoided, the hay is one of unusual sweetness and nutritiousness. Beal, in his work on the "Grasses of North America," says that in nutritive qualities it ranks next to Kentucky blue grass. Sprengel, a German author, remarks that "it is very nutritive, and its value is highest about the end of autumn." This last remark I understand as referring to it as furnishing pasture, for certainly so late in the season its nutritive value for hay could not be great.

MILLET.

In new regions there is probably no grass which has, all things considered, as great forage value as the ordinary millet, so well known throughout all parts of Nebraska. I may say right here that "Hungarian grass," "Bengal grass," "German millet," "Italian millet," "Mammoth millet," and "Golden millet" are all slight variations of one and the same species. Hungarian grass is a small and less developed state, in which the heads are small, as well as the whole plant, while the Mammoth and Golden millets have large heads and very large and well developed stems and leaves. It is a very common thing, as has been observed by many a farmer, to find that the next year after growing millet the fields are full of smaller and leaner

looking specimens closely resembling Hungarian grass. They are the stunted offspring of the millet.

Millet is one of the oldest of the cultivated grasses. It is a native of some portions of the old world, probably India, and has been grown in practically every part of the civilized world. In Africa, Turkey, Persia, India, Japan, and many other countries of the far east, it has been grown for ages. Originally it was largely grown for its grain, which was used for human food, and, in fact, it is now so grown in many parts of the world. The grains are very nutritious, and add very considerably to the value of the crop for the food of domestic animals.

As every farmer knows, millet is an annual plant, and must be sown in the same season in which it is cut for forage. This is one of the disadvantages connected with its culture, especially in this climate, where so many other crops must be sown in the spring. If it were possible in some way to secure a millet which could be sown in the fall, it would add very much to its value in this climate.

Millet is grown throughout the whole of Nebraska. I have seen fine crops of it in the extreme western counties of the state. Its hay is nutritious, although too frequently badly cured. For some reason which I cannot understand, less care is commonly taken in the handling of millet in making hay than in the case of any other hay making plant. If more care were taken, the value of millet as a hay plant would be very greatly increased. Even as it is, it is for this state at present a most valuable forage plant, and I have no doubt that it will continue to be so for many years.

BIG BLUE-STEM.

Among all the wild grasses that the plains produce, there is none which is more striking and conspicuous than the common big blue-stem. It is one of the largest and strongest growing of our grasses, and in good seasons covers the prairies with a tall, rank growth of nutritious forage. Although the stems are large and hard, they contain a great quantity of nutritious material, and if they are cut early enough, are greedily eaten by cattle and horses. Upon the unbroken prairie the big blue-stem is still a grass of great practical value, but, so far as I know, no considerable attempt has yet been made by any one to cultivate this grass from the seed, except upon small experimental plots. Experiments made upon the college farm show that big blue-stem can be easily propagated, and that it makes a good growth under cultivation. I have no doubt whatever that this grass can be brought under cultivation as easily as Kentucky blue grass and red top.

Big blue-stem grows wild in nearly all parts of the state, although there are some regions where it is not very abundant. It appears to be increasing in the eastern parts of the state, upon lands which are not cultivated. In the extreme western parts it is not very abundant, but it is evidently increasing there also. While not remarkably nutritious, it is so palatable, and its hay is produced in such quantity, that it has long been a favorite with the hay makers of the prairies.

BUSHY BLUE-STEM.

This grass is very much like the big blue-stem in everything excepting its head, which is bushy and quite spreading. It does not grow to quite the height of the preceding, but produces the same strong stem, with a large amount of leaves. Like it, also, it is inclined to grow in bunches. It is quite nutritious, the

stems being well filled with sugary or starchy matter, and consequently it produces a good hay. I have never seen the prairies covered exclusively with this grass, but it usually grows mixed with a good many other wild species. It very commonly grows along with the big blue-stem.

I have no doubt this grass could be propagated even more easily than the preceding one. Its large, spreading heads produce a great many seeds of good size, and these could easily be gathered and threshed. In fact, the seeds of this grass are of such size and shape as to make it probable that there can be no difficulty whatever in the securing of enough seed for sowing.

Both the big blue-stem and the bushy blue-stem are perennial grasses, and in this climate they are perfectly hardy. If a meadow were once filled with these plants, there would be very little difficulty in continuing it for an indefinite number of years. Both will produce good pasturage, and this will have the advantage of continuing a good growth throughout the whole season.

MUHLENBERG'S GRASS.

In my annual reports which I have made from year to year, I have had occasion frequently to refer to this grass. For years I have known of its good qualities, and I have year by year been strengthened in my good opinion of it. In the exhibits which are made annually at the State Fair, Muhlenberg's grass always appears, and invariably I find that it is well spoken of. It prefers moist land, and grows well in partially shaded places. It will doubtless prove very valuable in planted groves upon low lands, especially if the trees are not too closely set. In many respects it reminds one of orchard grass, to which, in fact, it is somewhat similar in general appearance. Among its valuable qualities may be mentioned first the fact that it branches very freely from the sides of the stems, so that each plant, by the time that it is fully grown, is a great mass of branching stems including a large number of leaves. I do not know of any other grass which is so given to branching as this one. The second point in its favor is high percentage of nutritious matter which it contains. Analyses made a number of years ago show that the per cent of nutritious matter is much more than that of Kentucky blue grass, and that, weight for weight, it is nearly four times as nutritious as timothy.

There are several difficulties, however, in the growth of Muhlenberg's grass, one of which is that it is rather a shy seeder, and this will always make it somewhat difficult to secure seed. Moreover, it appears to be somewhat difficult to start in the open ground, but it is probable that this difficulty will be overcome when we know more how to handle it. While I must confess to some disappointment in its not having commended itself more generally to the farmers for cultivation, I still think that it is likely to prove a valuable grass. Of this I am certain, that this grass is one having very many excellent qualities, and time, and a long series of experiments, alone can determine whether it can be accepted for general cultivation.

SWITCH GRASS.

The name switch grass has been applied very generally in this state to a large, coarse grass which is found in greater or less quantities throughout the state. It is known to the botanists under the name of *Panicum virgatum*, and is closely allied to the Indian millet, occasionally grown for forage. It is also related to

Hungarian grass and the ordinary millet, as well as to the common barn-yard grass. Switch grass is found growing wild upon the rich, moist soils of the prairies, where it attains a height of from three to four feet. It is very commonly found in bunches, but this is the case, probably, because the seeds have been dropped together. I think that if the seeds were evenly distributed through the soil, switch grass would form a coarse, tough sod. It is perennial, and is perfectly hardy. It starts up early in the spring and produces a good rich pasture. If allowed to stand until it comes into blossom it produces a large quantity of excellent hay. It seeds freely, and there would be no difficulty in gathering and threshing the seeds.

I do not know of any attempts at growing this grass than upon experimental plots, but feel confident that it would grow easily under cultivation.

WILD WHEAT GRASS.

In the central and western parts of Nebraska there is found growing, in greater or less quantity, a grass which frequently is called wild wheat grass. Some place, it is called wild blue grass. Occasionally it is known under the name of Colorado blue grass. It has also borne many other common names. Botanically, its name is *Agropyrum glaucum*, and it is nearly related to the old "quack grass" of the eastern states. In fact, it bears so much resemblance to that pest of the eastern farmers that at first sight it can scarcely be distinguished from it. It is a perennial grass, and when once it has possession of the soil will remain for many years. It is one of the hardiest of our native grasses, and may, therefore, be relied upon implicitly.

I have found that all through the western half of the state this grass is looked upon as one of the best of the wild forage plants. The farmers in western Nebraska invariably regard it as very promising, and in many places almost the entire hay crop consists of wild wheat grass. It occurs also in the eastern parts of the state. Patches of it can be found in the vicinity of Lincoln, where it is distinguished at once by its bluish green color. In the eastern parts of the state it grows to the height of from two to three feet, but in the western parts it is much shorter. It appears to be very nutritious, and we may well believe it to be so when it is known that it is a near relative of the ordinary grains—wheat, rye, barley, etc.

As this grass produces a good quantity of large sized seeds, there is no question but that it would be easily propagated. I should very much like to see some extended experiments made with this grass in the western part of the state. From my observation, I am led to think that it will do best on the lower lands where there is a fair amount of moisture, although, in all probability, the lowest lands will not be a valuable as those which are midway between the lowest and the highest.

GRAMMA.

Gramma is one of the most interesting of our indigenous grasses. It is perhaps the most striking of all the grasses which we have. In the wild state it is a low grass, never attaining to a greater height than ten to fifteen inches, but it produces a large amount of forage, in the form of numerous narrow but very nutritious leaves near the ground. These often form a dense and hair-like covering over large

areas of ground. The heads are well known, and occur either singly or two or three together on the sides of the delicate and slender stems.

Gramma is often called "buffalo grass," from which, however, it is quite distinct, although there are some considerable resemblance between the two. Grammas however, is much larger than buffalo grass, and, in my opinion, a much more valuable grass.

Some experiments made upon the college farm a couple of years ago would indicate that gramma may be made to grow much larger under cultivation than it commonly does in its wild state. Upon the experimental plots it reached a height of from eighteen to twenty inches, or even two feet. I am not yet prepared to recommend it as a grass for cultivation, and yet for the drier portions of the state it appears to me to have much promise. Perhaps gramma for the higher lands and wild wheat grass for the lower ones of the western part of the state may furnish much of the pasture and hay grass of the future.

RED CLOVER.

Of all the forage plants under cultivation at this time in America, no one is of greater importance than red clover. In many parts of the United States red clover is one of the absolute necessities in agriculture, and it is not too much to say that it has done more for the farmer than probably any other single plant. Indeed, Stebler, in discussing red clover in his recent work on "The Best Forage Plants," says of it: "Red clover has contributed even more to the progress of agriculture than the potato does, and has had no inconsiderable influence on European civilization. Its cultivation has led to an increased production of stock as food for man, and in this way has fostered and advanced commerce, industry, and science."

Important as the clover is at the present day, it is curious to note that it was introduced into cultivation only within comparatively recent times. According to Stebler, its first cultivation was undertaken about 400 years ago, in southern Europe, but it was not until the beginning of the last century that it began to be cultivated in Germany. In America it was first cultivated about 100 years ago.

A few years ago it was thought that clover could not be grown upon the plains. Even within the last ten years I have heard many people in the west declare that clover could not be grown with profit. It is not yet six years since I have heard men affirming with great vehemence their disbelief in the possibility of growing red clover even in southeastern Nebraska. A careful study, however, of the conditions which we have in this state led me early to the conclusion that there is no county in the state in which there are not extensive areas upon which red clover can be grown with great success. In the eastern part of the state there is now every indication that red clover will become one of the standard crops, not only for its forage, but for its excellent seeds, which are produced in very great quantities.

It has been found that red clover, when properly handled, will endure for more than two years upon the soils of Nebraska. This is a very great advantage, as it makes it unnecessary to renew the fields as often as in the eastern states. Nebraska, moreover, is not troubled with the "heaving out" of the clover, thus giving our farmers a very great advantage over their brethren in the east.

The only difficulty which we have in this state in the growing of clover is in securing a good stand. If the spring happens to be dry and windy, there is great danger that the seed will be blown away before germinating, or that the young

plants will be dried up before they have attained sufficient size to endure the heat and the drouth. It is advisable, under ordinary circumstances, to sow early, upon ground which is already occupied with a crop. Inasmuch as we do not grow winter wheat largely in this state, we are not able to resort to fall or winter sowing of clover. Where, however, this can be done, there is little question that it is much better than to wait until late in the spring, after wheat sowing. Where rye is grown, this will furnish a very excellent nurse for the young clover plants, and in this case the clover should be sown late in the winter, and it will be found to be better if this is done upon the snow. When the snow melts it will carry the seed down into the ground, where they will be securely kept from blowing away. It might be well to sow rye if for no other purpose than to serve as a nurse for the young clover plants.

Clover is one of the plants whose seeds are very often quite impure, on account of the presence of weedy seeds. It is probable that more weeds have been brought into the west in clover seed than any other way. I will not take your time to enumerate the many weeds which have been introduced in this way, but perhaps a few examples may profitably be given. The narrow plantain (*Plantago lanceolata*), several of the docks, fox-tail grasses, dog fennel, rag-weed, heartsease, and pig-weed. There are very many others, but these are certainly sufficient to show that there is great need of great care in the selection of clover seed. It is advisable that our farmers in the west should sow western grown clover seed, rather than that which is grown in the east, as by so doing they will very largely avoid the introduction of eastern weeds. Moreover, I am assured that western seed is heavier and better than that which is grown in the east, so that there is greater probability of its producing a good stand. Unfortunately, there is not yet enough home-grown seed in the markets to supply the demand. This condition of things, however, is not likely to last long, and it will not be many years before the Nebraska farmer can supply himself entirely with clover seed grown within the state.

ALFALFA, OR LUCERNE.

The last forage plant to which I will call your attention is one which is known in this part of the country as alfalfa, while in many places it is known as lucerne. It is also known in some places as Chili clover, and occasionally it is called French clover. It is a native of the old world, where it has long been grown. It is said that the Greeks and Romans grew it, and that to these countries it was brought from Persia, and possibly from the regions still further east. Its cultivation certainly dates back 2,000 or 2,500 years.

In this country its use has not been as great as its merits would warrant. It is very nutritious, and produces a very large amount of fodder. Upon the soils of Nebraska it has been shown to grow with great readiness, and when once well established, is likely to endure for a long time. It is particularly noted for the depth to which its roots will descend in the soil. According to Stebler a plant was observed in Switzerland with a tap root sixty-six feet in length.

In America, particularly in the western parts, alfalfa has been brought into cultivation mainly as a forage plant under irrigation. In Colorado, and some parts of western Nebraska, it has been extensively used, and when thus treated, it produces astonishing crops of nutritious fodder. Inasmuch as irrigation is likely to

be practiced more and more in this state, there can be no question but that it will be grown in increasing quantities year by year. I predict that in all the western counties of the state where it is possible to bring the water from the rivers upon the higher lands, alfalfa will prove to be of exceeding great importance for furnishing forage to domestic animals.

It is not a pasture plant to any considerable extent, but should be regarded as useful mainly for furnishing fodder in the form of hay.

In the foregoing pages I have treated briefly, and in a somewhat desultory manner the forage plants which, it seems to me, are of foremost interest at the present time in this state. I have attempted to show that they all are valuable, and that each one is adding very materially to the nutritious food supply of our domestic animals. I have attempted also to show that these plants are, in most cases, pretty readily grown, and that a considerable number of these are valuable in every part of the state. I might have added a number of others for particular portions of the state, but these are sufficient to show us that in this great state the grower of animals is not likely to want for nutritious food for his flocks and herds. Nature made good provision in the first place for the feeding of wild herds. Some of this provision still exists for our herds of cattle, and, doubtless, some of the plants which nature gave to these plains may be preserved by us under cultivation. But to these we may easily add a number of other plants whose value has been proved by long experiment.

THE SUGAR BEET INDUSTRY IN NEBRASKA.

BY PROF. H. H. NICHOLSON, DIRECTOR AND CHEMIST, UNIVERSITY OF NEBRASKA EXPERIMENT STATION.

Gentlemen of the State Board of Agriculture: In response to an invitation from your Secretary to address you at this meeting, I thought best to present for your consideration a brief statement of the work done during the past year in the line of the development of the sugar beet industry in Nebraska, under the auspices of the Experiment Station, together with some suggestions for a plan for the more efficient co-operation between the Station and the people of the state in ascertaining the facts underlying this industry.

Before proceeding to this discussion I wish, briefly, to refer to the work of last year. As you doubtless know, the chief point in last year's work was to determine whether or not our Nebraska grown beets were rich enough in sugar to make possible a successful beet sugar industry in the state. Incidental to this we sought what information we could get in regard to the tonnage yield and cost of production. With this statement of the objects it will be seen that the result of the work of last year pointed to very favorable conclusions. I speak thus guardedly in reference to these results because no one would expect to base final conclusions on the facts obtained in one season's work. A further need of caution arises from the fact that these beets were raised in a comparatively new soil, and by persons almost wholly inexperienced in the best methods of cultivation.

That we might not seem to base our conclusions on insufficient data, and in the hope of avoiding many of the difficulties that met us in our first year's experience, it was thought best to repeat, during the season just passed (1890), the same work, with the further idea of extending it, if possible, into every county of the state, and at the same time to so deepen and broaden it that it might include many facts not touched upon the first year. The campaign, as planned for this season, contemplated:

First—The establishment of sub-stations at convenient distances on the main lines of the Burlington, Union Pacific, and Elkhorn railways.

Second—Reaching and interesting the best farmers in each county by seeking the co-operation of the various county agricultural societies.

Third—A general co-operation with as many of the individual farmers as possible throughout the state, irrespective of locality.

By these means we expected to bring together a large number of valuable facts regarding the points of sugar content, yield, and cost, as well as to add to our knowledge of the variations due to the different soils and climatic conditions.

The location of sub-stations was conditioned on two facts:

First—The finding of men of sufficient public spirit to give us the use of plots for planting and who would agree to prepare the ground, plant, cultivate, and, in general, take care of the beets according to directions given them.

The second condition in making locations was the one of accessibility, as it was our intention to visit each station at least once a month.

At the sub-stations we planted four varieties of seed. Each variety in a plot ten feet square and in rows sixteen inches apart. The beets in the rows were to be thinned to various distances. We also supplied each sub-station with a standard rain gauge and two thermometers, one for the air and the other for the soil temperatures, together with printed directions for observing the same, and blanks for reporting tri-daily observations.

In order to secure the best results from these sub-stations, the Experiment Station appointed three field agents from young men who, because of their work in the chemical laboratory, had some knowledge of the requirements of the case. The duties of these agents were to visit the sub-stations periodically, to see that directions were being carried out in regard to taking observations, cultivation, etc., and who were required to report, monthly, in writing, to the home station, the exact condition of affairs at the sub-station. These field agents were also carefully instructed in the methods of taking specimens of soil for analysis and were directed to take samples from the beet plots at each sub-station. These samples were forwarded to the chemical laboratory to be analyzed and studied when time permitted.

Sub-stations were located, in accordance with the above mentioned plan, at Red Cloud, Orleans, Benkleman, McCook, Holdrege, Grant, Elwood, Minden, Hastings, Kearney, Lexington, North Platte, Ogalalla, Sidney, Kimball, Crawford, Alliance, Thedford, Broken Bow, Ravenna, Norfolk, Neligh, O'Neill, Long Pine, Valentine, and Chadron. Besides these, which formed a visiting circuit, we added Grand Island, Schuyler, Ashland, Omaha, West Point, and Bancroft, from which more or less regular reports were received. That we might be certain of reaching, in as effective a manner as possible, each county in the state the following circular was printed and mailed, in April, to the addresses of the secretaries of each county agricultural society, as taken from the last premium list of the State Board of Agriculture:

"DEAR SIR: During the past year the university has given some attention to the question of raising beets in Nebraska for the manufacture of sugar. The results of this work are published in Bulletin XIII, Experiment Station—a copy of which has been forwarded to your address.

"We intend to continue the investigation this season, in order to reach definite conclusions on several essential points, viz.: Average percentage of sugar in beets; per centage of substance not sugar; yield, cost, effect of soil, climate, and cultivation on the ratio of sugar, to the other substances present. It is also very desirable to obtain accurate records of the temperature of the air and of the soil, together with exact measurements of the rainfall.

"To make this more complete we desire to have beets of two or three varieties raised under our directions, in each county in the state. Will you name a man who will take seed, plant, and cultivate it according to directions, and report results. Seed, full directions for planting and cultivating, as well as necessary

apparatus, will be furnished by this department. Each station thus established will be visited, if possible, at least once during the season."

Many of these brought prompt responses and assurances of hearty co-operation. It was the intention to observe about the same line of investigation in these cases as at the sub-stations. It was expected also that some member of the Station staff would be able to visit each county station at least once during the season. It was found later that this would be out of the question as it required all the time to reach the sub-stations and keep up the office and laboratory work.

Outside of and beyond the plots provided for by these means, seed was put in the hands of something over 2,000 farmers, representing all sections of the state. In each case full directions were given for cultivating and answers to certain line of questions earnestly solicited. Such in brief was the general plan of the work as we entered upon it this season. This plan was carefully followed out in all particulars except such as were made impossible by lack of time or assistance.

From the time of planting until the last beets were harvested all reports, both from Station agents and individual farmers, were unanimous in the statement of the one fact, that the season was an exceptional one, both because of the excessively high temperature and the lack of the usual rainfall. With this was the united testimony of all beet growers, to the effect that their beets, where the seed had germinated at all and where the young plants had not been cut down by the early sand storms, were withstanding the unfavorable season much better than any other crop raised. It was both surprising and gratifying to have such reports from the driest and hottest sections of the state.

At the time of the State Fair it was thought best, in order to let the people see for themselves what had been done in sugar beet production during a season that all recognized as exceptional, to make a "beet exhibit." Those who had taken seed in the spring were asked to send samples to be placed on exhibition during the fair. In response to these calls we received, and placed on exhibition, beets from over seventy counties in the state. This exhibition attracted much attention and received most favorable comments both from the agricultural journals of the country at large and from our state papers. Analyses were not made at the time because the beets had not yet matured their sugar content. Since then we have received and analyzed somewhere in the neighborhood of 500 specimens, representing sixty-one counties in the state.

It is not possible now to give a full comparison of results with those of last year, because we have not yet had time to overhaul and study the material, reports, etc., that we have received from agents and others. A general comparison can be readily made on the one item of sugar content. Last year we analyzed 166 specimens, representing thirty-nine counties; 37 per cent of all these gave a sugar content of 12 per cent and over, ranging as high as 22.28 per cent. This year we have analyzed nearty 500 samples, representing sixty-one counties, and 72 per cent of this number have a content of 12 per cent and over, ranging as high as 22.5 per cent. The fact that a much larger proportion of beets this year were rich in sugar I attribute to two causes, namely, better and more careful cultivation (a result of last year's experience), and the long and dry autumn, which was very favorable to increasing the sugar content.

The interest of the farmers in this business has been stimulated by what they

have done this year, as is shown by the fact that, almost without an exception, they have asked that seed be furnished them that they might continue their experiment work at least another year. It is almost universally the case that these men in writing to the Station express a determination to profit largely by their experience of this year. I have now on file applications for seed from nearly a thousand farmers.

After this brief *resume* of the experimental work, and its results, let us turn for a moment to what has been accomplished this year in the way of practical sugar making, from beets, within the bounds of the state. As you all know, the people at Grand Island were the first in the state to make a practical application of the knowledge of the fact that Nebraska soil and climate was favorable to the growth of sugar beets. In the spring of 1890 contracts were made with the farmers in the vicinity of Grand Island for a certain number of acres of beets to be raised under the direction and supervision of the sugar manufacturer. In September the factory was in running order and began to receive and work up beets. The final result being, as near as I can ascertain, that about 400 tons of standard granulated sugar were actually made. This is of great interest in the way of a practical demonstration of the feasibility of introducing and making at home, in our state, a business that eventually can be of immense benefit to the state at large in the way of diversifying our agricultural industries. The practical result at Grand Island is all the more signficant because it has been produced during, what has been without doubt, the most trying season to the agricultural industries that the state has experienced, for a decade at least.

It seems then, from the information derived from these two sources, namely, the experimental work of the Station, and the practical work of the sugar house, that we may safely say that not only is our soil and climate favorable to sugar culture, but that it is especially adapted to it. Still I would caution against hasty conclusions, as there remains to be determined other important factors. Further than this it must be remembered that the season of 1889, as far as temperature and moisture were concerned, could be called a fair average of Nebraska seasons. That of 1890 was extreme in its heat and dryness. There now remains to be seen what results could be obtained during a cool and moist season, such as we sometimes experience here.

One valuable lesson, at least, can be drawn from the facts already observed and recorded, that is, that the successful culture of the sugar beet is not confined within any such narrow limits as has been heretofore supposed. European authorities have been of the opinion that this industry could not be successfully prosecuted where the average monthly temperature for June, July, and August reached above 70° F., and where the average monthly rainfall for the same time was less than two inches. In accordance with this idea Dr. McMurtrie, who visited Europe in 1878 to make a thorough study of the subject, published with his report a map of the United States, on which he indicated the regions that he considered the most favorable to the beet root culture.

The regions indicated, to use Dr. McMurtrie's language, "are confined to the north, including New England, New York, and a narrow band south of the lakes, Michigan, parts of Wisconsin, Minnesota, and Dakota. Here the line of the southern limit passes into the British possessions, and enters the United States again in western Dakota, and, crossing Washington and Oregon, passes to the coast in

the extreme north of California. In most of this we find a favorable temperature, and the average rainfall is sufficient in quantity, but we are unable to make any observations concerning the number of rainy days. In California the tables show that the temperature is sufficiently moderate, but from the examination of the figures for the stations for which the rainfall has been recorded, we find it to be remarkably deficient. Here, in order to make the culture a success, it would appear that the introduction of irrigation during the summer months would be an absolute necessity." It will be seen from this the conditions of climate that apply in Europe may have no application here, as both Nebraska and California are entirely without meteorological limits, determined from European experience.

Since the results of our experiments of last year have been published, the depart-partment of agriculture at Washington has issued another bulletin containing a map, on which is delineated a belt of country favorable to beet root growing. On this revised map the location of Dr. McMurtrie's "sugar belt" has been changed to accord with some of the facts lately developed. The southern boundary of the country favorable to the sugar beet, as laid down in Dr. McMurtrie's report, passes away to the north of even Iowa and Nebraska and entered the British possessions at the northern border of Dakota. On the revised map lately issued by the department of agriculture is shown a "sugar belt" extending a hundred miles on each side of Dr. McMurtrie's southern limit, except that, instead of passing north from Dakota, it makes an abrupt bend to the south, passing through and including western and northwestern Nebraska. The southern limit of this belt most favorable to the culture of the sugar beet root, according to the department of agriculture, enters Nebraska at the Omaha Reservation, passes westward through Cuming, Stanton, Madison, Antelope, Wheeler, and Garfield counties, when, bending abruptly south, it passes through Loup, Custer, Dawson, Frontier, and Red Willow counties, crossing into Kansas a little east of the 101st meridian. The northern and western limit of this belt enters Nebraska from the north at the 103d meridian and passes southwesterly through Dawes, Box Butte, Scott's Bluff, and Banner counties, crossing into Wyoming about the northwestern corner of Kimball county. The part of the state included between these lines is, according to the report of the department of agriculture, that part of Nebraska most favorable to beet root culture. But facts now known will make a still further revision of this map necessary, as probably three-fourths of all the beets grown in Nebraska have been grown outside of these limits. Some of the best yet obtained came from points without and beyond these lines, determined from meteorological conditions alone. The point I would emphasize in thus calling attention to the vagaries of the American "sugar belt" is, that we must avoid drawing conclusions in regard to the possibilities of the beet sugar industry in this country from facts obtained in European countries, or from an insufficient number of facts obtained on the ground.

It now remains to determine how we can establish in the state an industry which at its beginning seems so promising. It might be and probably is necessary, at the beginning of a new industry requiring so much capital for its successful conduct, to make special inducements to capital to interest itself. While it might be necessary to offer large bonuses to stimulate capitalists to make a beginning, yet I am firmly convinced that it is not necessary or even desirable that communities should continue to offer financial encouragement to capital to embark in a business which eventually must be very profitable both to the producer and the capitalist.

I have no doubt of the fact that there are men of means who would gladly seek investment here if satisfactory answer could be given to the further question of how much it costs to raise beets here and how large an average yield could be depended upon.

As I have before said, I am convinced that the most essential question, "Can beets rich in sugar be produced here?" has received a satisfactory answer. The further question of cost and yield we must determine experimentally. This belongs to the futur,e and an approximate answer we should be able to render next season. It is to this point that I ask your special attention that we may, if possible, co-operate in the bringing about of this desirable result.

The ideal way of reaching the fact, or facts, in the most thorough manner, is to have every farmer in the state grow one measured acre of beets, keeping a correct account of his expenses in so doing. It is true that ninety-nine hundredths of the farmers would not have access to a factory and could not market their crop, still there would be no loss entailed. Their beets, if not available for sugar making, would as a stock food amply repay them for the expense of raising. Of course I see the grave difficulties in the way of inducing every farmer, or even a large proportion of them, to raise and care for beets and to keep a correct expense account. What I seriously advocate is, that means be taken to induce as large a number as possible to plant *one square rod** of beets; to cultivate them according to directions that may be given, and to keep an account of all expenses involved, with the idea of knowing exactly in the fall what weight of beets his square rod has produced, and enactly how much it has cost him. In securing the co-operation on the part of the farmers it is desirable that this society co-operate with the Agricultural Experiment Station.

The State Board of Agriculture being the most influential agricultural body in the state, its action will have great authority and influence. Through its action county societies may be induced to secure the co-operation of the most thorough and influential individual farmers.

While I do not assume to formulate a complete plan of action, I would suggest to this body that it offer certain premiums to be competed for by the various counties. I would suggest that two equal premiums be offered; one for the best yield of beets weighing less than two and one-half pounds; the other for the best sugar percentage with the highest purity co-efficient. I think it would be well for the state society to use its influence to induce county societies to offer similar premiums for the best yield of small beets, high sugar content, and purity, to be competed for by individuals in the county. This I simply wish to have understood as a suggestion that perhaps can be worked out to a practical proposition by the mature judgment of the society. The greatest difficulty that I at present foresee is that of obtaining and furnishing seed to the individual. I am inclined to believe that greater interest and better results, as a rule, will be obtained if seed be furnished at cost, leaving the individual the entire expense, which in each case will not be large. I have thought, whether it is feasible or not I am not prepared to say, that this society might assume the responsibility of purchase of seed, which could be, in turn, sold to the county societies, or to such county societies as desired to obtain it, at cost, the county being in turn reimbursed by the individual taking the seed, paying its cost value.

* Such small plots are suggested because of the difficulty in furnishing seed in large amounts.

A well known authority states that a pound contains about 18,000 seeds, an ounce then will contain from 1,000 to 1,500 seeds.* A plot of ground one rod square will have twelve rows sixteen inches apart, and if the beets in the row are thinned to an average distance of six inches apart, each row will contain thirty-three beets, or the entire plot will have 396 beets. It is variously estimated that from twelve to twenty-five pounds of seed should be sown to the acre. Taking the maximum limit as the more desirable under the existing conditions, we have a rate of two and a half ounces of seed for each square rod. This gives us about 2,500 seeds with which to produce 396 beets. Therefore, if one seed out of six germinates, we would have as many beets as the plot would accommodate. Last year the seed purchased by us in Europe cost, laid down in Lincoln, all expenses paid, about twenty-five cents per pound. According to this, the individual taking from two and a half to three ounces will be at an expense of less than five cents for his seed. Supposing it is five cents, it is so small that it will not be noticed. If paid for by the individual he will have a greater interest in properly carrying out his work than if it cost him nothing. In this way this society, while taking the responsibility of making the first purchase, would be entirely reimbursed. The Experiment Station, for its part of the work, will endeavor to furnish careful and detailed instruction as to how to proceed in order to reach the best results in yield and sugar content, and will analyze free of expense all beets sent to the chemical laboratory, expressage or postage prepaid, and accompanied by full information relative to such points as may be determined on. We will also collect, collate, publish, and circulate all the facts arrived at in this and other ways.

While our plans for next season's campaign are not yet fully matured, I can say that we shall in general pursue a plan somewhat similar to the one in operation this season, to reach facts in regard to yield and cost.

On the Station farm we shall grow an acre or so of beets of the highest possible sugar content, from which selections will be made, to be used the next year for seed. Fertilizer tests with beets will also be undertaken, as well as tests of varieties. In general, we shall endeavor to study the possibilities of this locality as fully as possible.

*One thousand five hundred and eighty-three an average, by actual count, of four separate lots.

A PRELIMINARY REPORT ON THE INSECT ENEMIES OF THE SUGAR BEET.

BY LAWRENCE BRUNER.

The fact that sugar beets can be and have been profitably grown here in Nebraska, has been demonstrated beyond question, and that the subject is pretty well understood here in the state is conceded by all. This knowledge has been gained by careful and thorough investigation by those interested. The influence of climate, soil, and cultivation have all received faithful consideration in careful experiments. Everything, you will say, has been done that could be done in order to gain a complete knowledge of the entire subject of beet culture in all its bearings. Pardon me, then, if I should dispute your assertion.

Along with these various agencies in the successful culture of the sugar beet, and of equal importance with them, is that of combating insect enemies. While the other features of the subject are now pretty well understood, that of the insect enemies has been everlooked. That this is true is not at all surprising, when we reflect a moment, for is it not a fact that almost everybody seems to feel an utter contempt for everything in the form of an insect? It matters not how much injury nor how much good may result from one of these creatures, the notice it receives from the public is the same, viz., "only a bug." Be this as it may, the time is rapidly drawing nigh when these despised insects will receive some attention from these same persons who now totally disdain to even notice them. When their actual importance becomes duly impressed upon the tiller of the soil, they will then receive his attention after it will perhaps be too late.

The fact that all other crops and plants which we cultivate are more or less affected by noxious insects is a well established one, to the entomologist, at least, and therefore it was quite natural for us to suppose that the sugar beet would not entirely escape the ravages of at least some of these pests. True to our surmises, some of these enemies have already made their appearance in different portions of the region over which the crop has been grown during the three or more years of experimentation. Some of these have appeared in large numbers—numbers sufficiently great to materially injure the crop, even where grown on a large scale.

As an agent of the United States department of agriculture, the writer first began the study of these insects during the summer of 1889; but this was undertaken so late in the season and was so much interrupted by other matters that little was accomplished during that year. Early last spring, or about a year ago, it was thought best to continue these investigations begun the previous summer. It was therefore arranged here at the Experiment Station to devote some time to the investigation of these pests, along with others that injure the different established

crops of the state. Accordingly, the following "press bulletin" was prepared and sent out to the patrons of the Experiment Station:

"SUGGESTIONS IN REGARD TO THE SUGAR BEET CULTURE.

"Reports from the sub-stations established in the spring by the State Experiment Station for the purpose of determining the effect of the varying conditions of soil and climatic conditions on the growth of, and the production of sugar in, the sugar beet are, in the main, good.

"In many places, especially in the extreme western part of the state, beets have suffered from hot weather and a lack of rain, as a rule, though they seem to withstand these unfavorable conditions as well as corn, and even better than small grain.

"From some points reports tell us that insect enemies have begun their ravages. As there are several kinds of insects that attack the beet, and as they have already been reported as having begun operations, it seems the proper time to begin to learn something of their appearance, habits, and the best means of meeting their advances. To this end the beets should be watched very carefully, from day to day, and at different times of the day and evening, for any insect, bug, or worm that seems to have an interest in them. Search the leaves, pull up the beets and search the roots and the top layer of the soil, and when any marauder is found, send it to the Experiment Station for study and identification.

"Directions for sending such specimens I copy from Bulletin XIV, on 'Insects Injurious to Young Trees on Tree Claims,' just issued.

"'Whenever possible, insects should be packed alive in some tight tin box—the tighter the better, as air holes are not needed—along with a supply of their appropriate food sufficient to last them on the journey; otherwise they generally die on the road and shrivel up.

"'Send as full an account as possible of their habits, what part of the plant they infest, time of day when they are most active, amount of damage done, etc.

"'Packages should be marked with the name of the sender and addressed to the entomologist of the Agricultural Experiment Station, Lincoln, Neb.'

"It will aid very materially in forming conclusions if all people who have planted seed will send, from time to time, reports of the condition of their beets to the Experiment Station. (Signed) H. H. NICHOLSON, *Director.*"

In compliance with the above request for aid in this line of investigation, there were soon received at the office of the entomologist package after package of insects that were taken in beet patches, some of them useful or beneficial species, and the others injurious species that were known to us at the Station from prior meetings. In all, there were a host of them—very many more than we ever imagined would be found to attack the beet.

The very dry summer may have had considerable to do towards influencing much of the insect injury to the beets grown within the region designated; and some species of insects may also have worked upon this plant that ordinarily would not have done so. In many localities there were also observed to congregate among the leaf stems, just above the ground, various other insects that could not have been there for mischief, since they were such forms as do not ordinarily feed upon growing vegetation. Especially was this true in portions of the state

where the drought was severest, and where other refuges from the burning sun and parched soil were scarce or entirely wanting. In many of these localities a great variety of insect life is always sure to be found hidden away during daytime in such places as the beet tops provide. Not only were beetles found here, but also representatives of such other orders as the Hymenoptera, Hemiptera, Neuroptera, Orthoptera, Diptera, and Lepidoptera occurred in almost equal numbers in each of the regions which were visited by agents of the Station or from which specimens were received through correspondents. Even many water-inhabiting forms very frequently occurred in company with the others. Of course, all of these miscellaneous insects that were found on or about the roots of beets were sent in to the Stations both by the field agents and by the various correspondents who took an interest in the investigations under way. To separate most of these "refugees" from such other forms as might possibly be there for mischief was, of course, quite easily done after they had arrived at the Station, by those who were accustomed to the habits of the forms under consideration. A few of them were, however, more difficult to single out, and required special study to tell to which of the two classes they properly belonged. This was easily done in nearly every case, but in a very few instances the species are still among the doubtful ones.

In the study of this subject it was quickly demonstrated that almost all of the insect enemies of the sugar beet, as well as of the common garden and other varieties, were either weed-feeders or else were such as are very general feeders. It was also ascertained that nearly, if not quite all of the insects of whatsoever description that attack other Chenopodiaceous plants, as the various species of "Tumble-weeds," the "Pig-weeds," Atriplices, etc., the Purslane, and other juicy weeds, as also many of those that attack the various Cruciferæ and Solanaceæ, will also feed upon the beet. Not a single species of insect has thus far been reported by any of the agents of the Station, or by correspondents, that is exclusively a beet-feeder. Every one of them has been ascertained to attack some one or more of the other plants just named and that are common to the regions from which the specimens were received. Only a very few of these species have thus far appeared in numbers sufficiently great to be what could be properly termed "destructive" to the beet within the region covered by these studies or investigations; and these few are of such a nature as will readily admit of their being combated.

In their modes of attack upon the beet these various insects, so far as they have been studied, are either leaf-feeders or root-feeders; *i. e.*, they either attack the foliage, which they devour, or from which they suck the juices by inserting their beaks, or they bore into or gnaw away the roots. Later on in our investigations we may find that there are others that will attack the seeds and seed stem. In either of the former cases the result is an injury to the beet, whether it is being cultivated for the table, for feeding to stock, or for the manufacture of sugar. Should further study reveal others that attack the seed of the beet, these latter would, of course, be of direct injury to the seed industry, since much seed will have of a necessity to be raised to provide for the large crops that are required each year for sugar.

Having now become thoroughly convinced that the cultivation of the sugar beet is not entirely without its drawbacks in the shape of insect pests here in the west, against which we must contend and which must be overcome in raising this crop, as well as there are in raising of corn, wheat, and potatoes, we see the necessity

of beginning the fight at once if we would prevent much future loss. By prompt action in the beginning, when the enemies are comparatively few in number and less generally distributed, we will have a much easier time in checking their ravages and in ridding our crops of them. Besides, our losses from this source will be infinitely smaller than if we were to neglect them and permit them to go on increasing and spreading unmolestedly from year to year.

It has been estimated that at the least calculation, the average loss sustained year after year to each and every crop from the ravages of injurious insects will not fall below fifteen per cent of the whole. In most instances this estimate is too small by half. Count everything raised on the farm, in the garden, orchard, vineyard, nursery, flower garden, etc., within the state of Nebraska by its money value and we have a grand array of figures. Then ascertain how much fifteen per cent of this sum would be, and you will know of what importance, financially speaking, these insignificant creatures are that you treat with so much contempt. Fifteen per cent of the produce of the entire state for a single year would more than care for the drouth sufferers of our western counties during the present winter, and that too in no niggardly style.

We can readily see how easy it is for these various crops to be injured to the extent named, when we really have learned the facts of the case; but otherwise it is hardly possible to do so. "Where ignorance is bliss 'tis folly to be wise" is all very well when no money is at stake, but when the result of this ignorance is depriving us of dollars and cents at the rate of one out of every seven, it behooves us to become wise. How do we know that these insects are harming us to this or any other extent? Who has ascertained these facts, if facts they are? When the Chinch Bug and Migratory Grasshopper visits us along "with his cousins, uncles, and aunts," there is no necessity for resorting to figures in order to ascertain this fact. Why then should we be obliged to do so when we are assured by those who should know, that each one of every crop that is raised is attacked by several dozen different kinds of insects, all of which are usually present in moderate numbers? As an example of how many different kinds of these insect enemies may be working upon any one of our crops, a list of those found to attack the beet is given here.

The following list embraces all such species of insects as have been found by us to injure the beet in Nebraska or else have been recorded by others as attacking this plant within the region embraced in these studies.

In the preparation of the list it has been necessary to use the entomological names to the exclusion of popular or common ones simply for the reason that most of the insects which are mentioned here are without "common" names.

LIST OF BEET INSECTS.*

Species that Attack the Leaves.

LEPIDOPTERA.

1. *Spilosoma virginica*, Fab.—The larva of this very common insect is one of the first noticed to injure the beet. It also infests a large number of other plants.
2. *Spilosoma isabella*, Abb.—The larva, like that of the preceding, attacks the beet and many of our common weeds.

* From Bulletin No. 23, U. S. Dept. Agric., Div. Entomology, pp. 13-17.

3. *Mamestra picta*, Harr.—Larva occasionally attacks the leaves of beet and other garden plants.

4. *Eurycreon rantalis*, Guen.—The larva of this small Pyralid moth is one of our most destructive beet insects. It is the one usually known as the Garden Web-worm; and also attacks a number of other plants, among which are the "Pig-weed," the tumble-weed, purslane, etc.

5. *Mamestra trifolii*, Rott.—Larva quite common on beets; and sometimes doing considerable injury by gnawing away the leaves and the entire tops of small plants. Also a purslane insect.

6. *Plusia brassicæ*, Riley.—The larva occasionally attacks the beet, but more commonly the turnip, cabbage, and other Cruciferæ.

7. *Deilephila lineata*, Fab.—Larva found feeding on beet leaves in Lincoln, Neb., by Mr. H. Marsland. A very common purslane insect.

8. *Copidryas gloveri*, G. and R.—Taken several times on the leaves of beets which it had eaten more or less. An abundant purslane moth.

9. *Agrotis*, spp.—Several species of these "cut-worms" are occasionally quite destructive to the beet while it is still small. They work more or less all summer, but are most destructive early in the year. They cut off the plant just at or a lit le below the surface of the ground. Some of them also work upon the leaves above the ground.

10. *Leucania unipuncta*, Haw.—The Army Worm, when it is abundant, does considerable damage to beets and other garden plants by eating their foliage.

11. *Botis pesticata*, Grt.—The larva of this moth is said to be quite destructive to a number of plants here in the west. "In 1873 we found the larvæ feeding upon Helianthus, Ambrosia, potatoes, and beets, skeletonizing and ruining the plants for miles along the Neosho valley and throughout Kansas," writes Professor Riley in the U. S. Agricultural Report for 1883.

ORTHOPTERA.

12. *Melanoplus femur-rubrum*, DeG.—Occasionally injuring the leaves of beets and other vegetables.

13. *M. atlanis*, Riley.—When common, a general feeder, at least upon the products of the garden and farm—beets, of course, included.

14. *M. spretus*, Thos.—Attacks the beets during times of invasions, sometimes entirely eating away leaves and portions of root that protrude from the ground.

15. *M. differentialis*, Thos.—When plentiful it occasionally does some injury to the foliage of the beet and other garden plants.

16. *M. bivittatus*, Say.—Where beets are planted on low ground or are growing close to some rank vegetation, it attacks their tops, but never does much damage.

17. *Dissosteira carolina*, Lin.—Found feeding upon the tops of sugar beets during the month of July, at McCook, Neb.

18. *Trimerotropis latifasciata*, Scudd.—Taken in company with the preceding, also feeding on sugar beets.

19. *Spharagemon æquale*, Scudd.—Several specimens were received during the sum-

mer from McCook and Ravenna, Neb., with the accompanying statement to the effect that they fed on the sugar beet.

20. *Pezotettix olivaceus*, Scudd.—I have seen this hopper in beet fields several times under such circumstances as led me to think it feeds upon that plant. It is also quite partial to Helianthus and Chenopodium.

COLEOPTERA.

21. *Diabrotica 12-punctata*, Oliv.—Quite common on the leaves of beets, which it injures by gnawing holes in them.

22. *Disonycha triangularis*, Say.—The beetle feeds upon the leaves of beets and other Chenopodiaceous plants. Sometimes quite common here in the west.

23. *D. cervicalis*, Lec.—Has similar habits to the preceding, but is less abundant.

24. *D. xanthomelæna*, Dalm.—Common on beets and other Chenopodiaceous plants, the leaves of which it riddles with holes.

25. *D. crenicollis*, Say.—One of the 5-lined flea-beetles that occur here in moderate numbers; is also occasionally taken on beet leaves at Lincoln, Neb.

26. *Systena frontalis*, Fab.—Found feeding upon beet leaves on the College farm, Lincoln, Neb.; also on the leaves of *Hibiscus militaris* at West Point, Neb.

27. *S. tæniata, var. blanda*, Melsh.—A very numerous species in all parts of the state from which beet-feeding insects have been received. It literally riddles the leaves of beets with pit-like holes, in some instances entirely destroying the leaves of quite large plants. I have also taken it upon white clover, purslane, and amaranthus. This is liable to be one of our most destructive beet insects here in the west, especially in Nebraska.

28. *Psylliodes convexior*, Lec.—Another of the flea-beetles that is very abundant on the leaves of beets in some portions of Nebraska, and which works in a somewhat similar manner to the preceding.

29. *Chætocnema denticulata*, Illig.—I found still another of our small flea-beetles at work on the beets growing on the State farm here at Lincoln, although in much fewer numbers than either of the two species preceding.

30. *Epitrix cucumeris*, Harr.—This small flea-beetle was found to be quite abundant at Ashland, Neb., where it was taken by Mr. T. A. Williams, upon the potato, *Solanum nigrum*, and the beet, the leaves of all of which were more or less closely riddled with holes.

31. *Epicauta pennsylvanica*, DeG.—This black blister-beetle injures the leaves of quite a number of plants, prominent among which are the potato, "pig-weed" and beet. It has been received at the station from central and western Nebraska as one of the most destructive insects attacking the plant.

32. *Epicauta cinerea*, Forst.—Another of these blister-beetles was found here at Lincoln by Mr. Herbert Marsland, who said it had almost ruined a small bed of beets growing in his garden. I have also collected the same species from one of the wild beans and several other native plants.

33. *Epicauta maculata*, Say.—This insect has been received from Medicine Lodge, Kan., and from Grant and Neligh, Neb., where it was found to injure the sugar beets by feeding on the leaves. It is a very common insect here in the

west upon quite a number of the Chenopodiaceous plants, and especially upon the various species belonging to the genera Chenopodium and Atriplex.

34. *Epicauta vittata*, Fab.—This striped blister-beetle is also a beet insect; and has been received from Ogalalla, this state, where it was reported as doing much damage to sugar beets. It also is quite a general feeder. Among its food plants are to be mentioned the Solonaceæ, some of the Leguminosæ, and I have found it to be quite destructive to several of the Sagittariæ.

35. *Epicauta cinerea, var. marginata.*—This large black blister-beetle also frequently gathers upon vegetables of different kinds in the semi-arid regions east of the Rocky mountains, but chiefly upon beans. I have taken it on beets once or twice here in Nebraska.

36. *Cantharis nuttalli*, Say.—During the late summer and early fall of 1888 this insect was very destructive to garden plants, beets included, in the Black Hills of South Dakota. It also abounds in the western and northwestern parts of Nebraska.

37. *Colaspis brunnea*, Fab.—This small leaf beetle, which appears to be quite a general feeder, has been taken on several different occasions upon the beet, both by myself and different ones of the field agents, and also by some of the correspondents.

38. *Epicærus imbricatus*, Say.—The Imbricated Snout-beetle has been known to attack the beet among the many other plants upon which it feeds. It is a general feeder.

39. *Centrinus penicillus*, Hbst.—Another of the Snout-beetles that attack the beets here in the west is the one known to the entomologist by the above name. It gnaws small holes in the leaf-stem, and when numerous does considerable harm to the plants attacked. Whether or not the insect breeds here I was unable to ascertain.

40. *C. perscitus*, Hbst.—Still a third species of weevil was found upon the beets growing on the State farm. It is a much commoner insect than *penicillus*, and works in a similar manner upon the leaf-stem.

31. *Apion*, sp.—This little Apion was taken on the leaves of beets here at Lincoln, on two separate occasions.

42. *Doryphora 10-lineata*, Say.—The Colorado Potato beetle was brought into my office at different times during the summer by those who reported its having been captured on the leaves of beet which it was "certainly eating."

HETEROPTERA.

43. *Blissus leucopterus*, Say.—The Chinch Bug has quite frequently been taken by me upon beet tops, in company with several others of the plant bugs. Whether or not it was there only temporarly, I cannot say; but, suppose it was, since all of our leading entomologists assert that its food-plants are limited to the grasses.

44. *Piesma cinerea*, Say.—A very common bug on the beet and various others of the Chenopodiaceous plants. Sometimes doing much damage to the leaves of the former.

45. *Nysius angustatus*, Uhl.—Another bug that often gathers upon the beet and

other garden plants is what is called the False Chinch Bug. When numerous it often does considerable harm to the plants which it attacks. It is also one of the weed insects that enjoys a wide range.

46. *Geocoris bullatus*, Say.—The Large-headed False Chinch Bug, or Purslane Bug, is also much addicted to infesting the beet here in Nebraska. In fact, it has been received from all over the state as one of the commonest of insects infesting the beet. It is also a great weed bug.

47. *Trapezonotus nebulosus*, Fall.—This bug also frequents the beet and several other Chenopodiaceous plants. It is especially partial to the Pig-weed (*Chenopodium album*) here in Nebraska.

48. *Emblethis arenarius*, Linn.—Taken several times on the beet in company with the preceding. This insect also is a frequenter of localities where *Chenopodium album* is growing. This species also occurs about the roots of "Stink Grass" (*Eragrostis major*).

49. *Lygus pratensis*, Linn.—Probably one of the most general feeders among the true bugs, and sometimes a very destructive enemy of the beet. It occurs throughout the entire North American continent in the temperate regions.

50. *Euthoctha galeator*, Fab.—This bug has also been taken several times on the beet in the vicinity of Lincoln, Neb. I have collected it also from the wild cucumber (*Echinocystis lobata*).

HOMOPTERA.

51. *Agallia siccifolia*.—This little leaf-hopper, which seems to be especially partial to the different species of Amarantus and Chenopodium and allied weeds, is also equally fond of the beet, at least such would appear to be the fact, judging from the large numbers of the insect that are invariably to be found upon this plant all through the summer. It occurs in all stages.

52. *Immature forms only*.—Found in moderate numbers on the sugar beet at Grant, Neb., a rather large leaf-hopper, which also occurs upon the Amarantus and Chenopodium.

53. *Allygus sp*.—This prettily marked leaf-hopper is very partial to *Chenopodium album*, on the under side of the leaves of which it breeds throughout the summer. This insect also attacks other species of the same genus, those of the genera Amarantus and Montilia, etc. Besides these it is very frequently found on the beet. Characteristic marks of its presence are the rather large purplish spots that are seen upon the leaves of the plants that have been punctured by its beak.

54. *Erythroneura sp*.—Another small, slender, green leaf-hopper that is occasionally met with upon the beet.

55. *Athysanus* (*? sp*.).—Still another of these leaf-hoppers that is found upon the beet.

56. *Liburnia intertexta*.—There is still a sixth of these leaf-hoppers that has been taken on the beet here in Nebraska; and which presumably also does some injury to that plant by sucking its juices.

57. *Aphis atriplicis*, Linn.—Mr. T. A. Williams tells me that he has taken this plant-louse on the beet at Ashland, this state, where it was quite common during the year.

58. *Aphis cucumeris*, Forbes.—This past summer Mr. Williams also took what he determined to be the *Aphis cucumeris*, Forbes, breeding quite abundantly upon some beets that grew right by the side of some cucumber vines that had been infested by the same insect.

59. *Siphonophora pisi*, Kalt.—The same gentleman tells me that he has also taken the common garden aphid here at Lincoln, on the beet. He found it in the pupa and winged stages.

Species that Attack the Root.

COLEOPTERA.

60. *Ligyrus gibbosus*, DeG.—This beetle has been quite destructive to the sugar beet over limited areas towards the western part of the state during the present season. It attacks the root, into which the mature insect gnaws great holes, sometimes entirely imbedding itself. It worked most on old ground and where irrigation was resorted to. It worked on the roots from the surface to a considerable depth but most at about 3 or 4 inches below the surface. In some instances it reached a depth of fully 7 inches below the surface.

61. *Lachnosterna fusca*, Froh.—Not unfrequently the common white grub attacks the roots of the beet, and does injury to the plant in that way. There are very likely several kinds of the "grub" that are concerned in these attacks, since almost every locality has its particular species of "June bug" that predominates in numbers.

62. *Wire Worms.*—Several of the larvæ of the "snapping beetles" or click beetles, are also to be charged with injuring the roots of beets in some localities.

63. *Unknown larva.*—On two different occasions during the past summer I found beets that had been attacked by some unknown larva just below the surface of the ground, and from which the depredator had already escaped. The work resembled that of an insect that works in the roots of different "tumble-weeds" and causes them to break off. The larvæ are rather short, thick, whitish grubs with brownish heads, about one-fourth of an inch in length, slightly largest in the middle; possibly the larva of some snout beetle.

UNCERTAIN.

64. *Silpha opaca*, Linn.—This insect has been taken several times by me in beet fields, and in gardens where beets were growing. In Europe the insect is said to be quite injurious to the beet crop by attacking and devouring the leaves. Whether or not it has the same habit in this country I cannot say.

The insects in the foregoing list have been actually taken at work on the beet, and there is no guess work about it. Others will undoubtedly also be added to this list from time to time as the study of these pests continues from year to year.

Of the different insects mentioned in the foregoing list—seventy-two or more in all—there are but about a dozen that have thus far proved to materially injure the crop which they infest, *i. e.*, that number among the lot can be said to injuriously affect it. These dozen or so are the ones that will require our special attention immediately; and the other five dozen, more or less, can be looked after

later, or only casually from time to time as matters permit or as necessity demands.

The recent preliminary study for the government and here at the Station of the different insects that attack the sugar and other beets has resulted, as is shown by the above list, in the discovery of more than seventy distinct species or kinds that in one way or another injure that plant. When these studies will have been carried out more fully, as is the present intention of the Station staff, the number will be considerably increased even beyond these figures, which now appear large to all of us. Even the entomologists of the country were not aware that the beet suffered to so great an extent as it really does from this cause, simply because they had not given the subject the attention which it deserved.

Do not let what is now said on the subject of insect enemies of the beet prevent anyone from entering into the cultivation of that plant for profit. On the contrary, go at it the more assured, knowing that there is something being done towards the prevention of the increase of these pests. Even if it is shown that the beet is attacked by a host of these enemies, the number is comparatively small compared with those that attack some other crops. The oaks of this country and Europe are affected by fully 1,000 different kinds, the cottonwoods or poplars by more than half that number, the apple by nearly or quite two hundred, etc.

During the short time that has been devoted to these investigations now under consideration, several important facts in relation to the subject of economic entomology were demonstrated. One of these was, the promptness with which a new crop is attacked by insect enemies in a new region. Another fact that has been clearly defined, is the readiness with which an insect can adapt itself to a new food-plant, even to the almost entire desertion of its original or natural one. These investigations have demonstrated the necessity of studying the habits and natural history of even our weed-feeding insects that belong to a given region. This becomes necessary from the fact that there is no telling when any particular one of our non-injurious species may become just the opposite, by attacking some newly cultivated plant or plants, or by transferring its attacks from wild to cultivated plants. It is therefore just as necessary for the economic entomologist to learn the life-history and characteristics of these weed-feeding species as it is for him to be acquainted with the characteristics of those that are known to be among the most destructive enemies of cultivated plants as we know them at present.

Take any weed and begin to cultivate it so as to make it a permanent thing, and it is very quickly set upon by various insect enemies. So we must expect in the cultivation of the sugar beet to have some little trouble with these insect enemies. If, however, we begin to fight them from the very beginning the task will be comparatively light.

Now, to conclude this preliminary report on beet insects, it will be in order to suggest some remedies that can be used against them in common, after which about a dozen of those that are the most destructive will be treated separately.

It will be quickly seen by any one who has taken the pains to go over his beet field, or who has followed this paper, that in nearly every case the insect enemies of the beet are identical with those that work upon our commonest garden weeds; or else they are such as are very general feeders. It will also have been observed that most of them are leaf-feeders; *i. e.*, they nearly all attack that portion of the plant above the ground. These being the facts as observed in the case, the remedies that

at once suggest themselves are quite simple. A spray of some kind that is repulsive or poisonous to the insect if scattered over the plants will be effectual as well as economical. The beet tops are seldom utilized for food either for man or beast. Hence, for protection against insects with gnawing mouth-parts that attack them, an arsenical spray may be used; whilst, on the other hand, for such as receive their nourishment by means of a sucking mouth, the kerosene emulsion will answer the purpose. This latter remedy will also be effective against the flea-beetle above referred to, as has been demonstrated by actual experiment during the the past summer by one of our correspondents, who writes that "the kerosene emulsion which you directed me to try on my beets against the flea-beetles was a perfect success."

In conclusion, I wish to emphasize the fact that the careful destruction of all such weeds as furnish food for the same insects that also attack the beet will be a material aid in keeping these enemies under control. Clean culture in this case becomes doubly necessary. First, to prevent the appropriation by the weeds of nourishment that should by rights be taken by the beets; and secondly, to give ess opportunity for the propagation of injurious insects.

The following notes on special beet insects are herewith reproduced from Bulletin No. 16 of the Agricultural Experiment Station:

THE GARDEN WEB-WORM.

(*Eurycreon rantalis* Guen.)

One of the most, if not the most, destructive of our beet insects up to the present time has been the one shown in Fig. 1. It is known by the name of the Garden Web-worm, from the fact that it spins a web while feeding; and "Garden," because it is a garden frequenter rather than a field inhabitant. Systematically it belongs to the family of moths which bears the name of *Pyralidæ*, the members of which are all more or less injurious. It has been quite thoroughly treated in Professor Riley's annual report to the Commissioner of Agriculture for the year 1885, pp. 265–270. I will therefore quote quite largely from that source.

In referring to the distribution of this insect that author writes as follows: "*Eurycreon rantalis* is quite a wide-spread species, occurring all over the United States. It has been captured in South America, and the original description of the species was from a specimen from Montevideo. It is also a very variable species, and has been variously described under the name of *crinisalis*, by Walker; of *communis*, by Grote, and of *occidentalis*, by Packard."

DESCRIPTIVE.

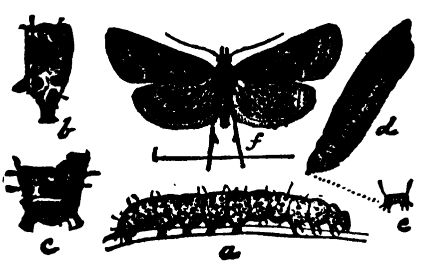


FIG. 1.—Garden Web-worm (*Eurycreon rantalis*): *a*, larva; *d*, pupa; *f*, moth—all slightly enlarged. [After Riley.]

"The moth (Fig. 1, *f*) has an average expanse of 18mm. The general color is either orange or reddish-yellow, inclining to buff, or more commonly a lighter or darker shade of gray, having, in certain lights, either a copperish or greenish reflection very similar to that on the well-known Cotton Worm Moth (*Aletia xylina*). The characteristic markings, as shown in the figure, are the darker reniform and orbicular spots, with a

paler shade between them; two irregular transverse pale lines, generally relieved by darker shade, most intense posteriorly on the anterior line and basally or interiorly on the posterior line. The terminal space may be either paler or darker than the ground color. The markings are very variable, however, dark specimens (*rantalis*) having them all well defined, paler specimens (*communis*) less so, while in others (*crinisalis*) the anterior line and inner portion of posterior line may be lacking."

"The larva * * * is also somewhat variable in color, being either pale or dark-yellow or even greenish-yellow. It is marked with rather distinct jet-black piliferous spots, as illustrated in the figure. The piliferous spots are also more or less distinctly relieved by a pale border.

"The pupa is of the normal brown color and characterized by the tip of the body having two prominences, each furnished with three stout, short spines."

Although this insect is known to extend over a remarkably large area, its injuries have thus far been confined to the region between the Missouri river and the Rocky mountains; nor has it been observed here to any great extent—at least, north of the Platte river. This area is, however, quite liable to be increased with the general cultivation of the soil in the beet belt.

FOOD-PLANTS.

Like many of our more injurious insect pests the "Garden Web-worm" is quite a general feeder. It is especially one that will need our watchful care if we hope to keep it within bounds, for it is one of the very few species that is a genuine weed feeder. In fact, it is more partial to some of the weeds than it is to cultivated plants. Professor Riley speaks of the food habits of this insect as follows in the report already referred to: "There is no question but that the preferred food of this species is the foliage of plants of the genus *Amarantus*, called in different parts of the country Amaranth, Pig-weed, and Careless weed. This was very noticeable in our observations of 1873, and its next preference seemed to be Purslane. Professor Snow also mentions Lamb's Quarter (also called "Pig-weed" *Chenopodium*), as a favorite food plant. Professor C. E. Bessey, writing from Lincoln, Nebraska, August 11, mentioned an unusual abundance of these larvæ upon *Amarantus retroflexus* and *A. blitoides*. Another correspondent mentions finding them the present year (1885) upon the common Cockle-burr (*Xanthium strumarium*), but this was probably due to their excessive abundance and want of proper food. This, also, is probably the case with the common Burdock (*Lappa*), which is mentioned by anothe rcorrespondent. Professor Popenoe mentions, among the weeds injured, *Amarantus alba*, *Chenopodium album*, *Ambrosia trifida*, *Apocynum canabanum*, and *Grindelia squarrosa*. He also mentions the fact that they injured a bed of scarlet verbenas."

The following are the cultivated plants that it has been observed to feed upon: Corn, cotton, cabbage, cucumber, castor beans, melon, squash, pea, beans, red clover, alsike, alfalfa, pumpkin, sweet potato, Irish potato, egg plant, tomato, orchard grass, timothy, meadow oat grass, millet, flax, tobacco, sugar cane, lettuce, onions, and beets, besides others. Thus it will be seen that the insect is a more general feeder than might at first be supposed. In fact it appears to be able to feed on almost anything.

HABITS AND NATURAL HISTORY.

Under this heading, Professor Riley, whom I have already quoted largely, says: "The full natural history of the species has not yet been made out. The eggs have not been described, the method of hibernation is not positively known, and the number of annual generations has not been carefully determined."

The insect is evidently a many-brooded species, since indications point to at least three or four sets of the moths during the spring, summer, and fall. The larva is a web-maker, and always spins as it goes and constructs a sort of retreat in which it remains during the day-time at rest. It is described by Professor Popenoe in the second quarterly report for 1880 of the Kansas State Board of Agriculture. He says: "The following points in its history are the partial result of my study of the insect. Although I made careful search for the egg, I failed to discover it *in situ*, but it is without doubt deposited on the lower side of a leaf, or low down among the bases of a cluster of leaves, as newly hatched larvæ are found in both these situations, from which they soon wander to other parts of the plant. As soon as it (the larva) begins to move about it begins to spin the web, and this is increased in extent as the movements of the larva are extended. It is very active in all stages of growth as a larva, and springs aside quickly when touched, sometimes throwing itself into a coil, but more often running rapidly away. At least in early life the larva, when thrown off a leaf, will hang by a thread of silk. In case a single leaf is of sufficient size, as in the sweet potato, the well-grown larva is generally found on the upper side in a shelter formed by drawing partly together the edge of the leaf by the silk of its web. In this shelter it is usually found at rest during the day, hanging by its feet, back downward, to the lower surface of the web. In other plants several leaves may be drawn together for a place of concealment. If, indeed, the larvæ are not partially gregarious, they are at least not disturbed by proximity to each other, as several may be found at times in a common web, allhough I believe this is exceptional. As they are forced to move to new parts of the plant for fresh food their webs are extended until finally the entire plant is covered. The young larvæ devour only the surface and substance of the leaf on the side where they are, leaving the veins and the opposite epidermis untouched, producing a "skeleton" leaf. As they grow older, however, they devour all portions of the leaf, and often eat also the petioles and tender stems. Opportunity has not been given to determine the exact length of the larval life of this insect, but judging from observations made, this cannot greatly exceed a week. Parties living in the region where the insect was present in great numbers give ten days as the length of the time in which the chief destruction was accomplished."

Although I have never paid personal attention to this insect, it is learned from the records of others that, when full grown, the larva spins for itself a delicate silken cocoon among the debris on the ground at the base of its food plant, and transforms to the pupa or chrysalis stage. It remains in this last from one to two weeks.

NATURAL ENEMIES.

Like all other injurious insects, this one is quite certain to have its insect enemies, both parasitic and predaceous. Some of the ground beetles, like those illustrated in Figs. 2, 3, and 4, feed upon the larvæ, while a Tachina fly has been bred from them in Kansas by Professor Popenoe.

Where the insect attacks the beet, and where the tops are not intended to be fed

to stock, the best remedy will be the use of one or the other of the arsenical sprays so often recommended for the destruction of other insect pests. These are composed of either London purple or Paris green, in the proportion of 1 pound to 200 gallons of water, and applied with a sprinkler or force pump, the latter being the best.

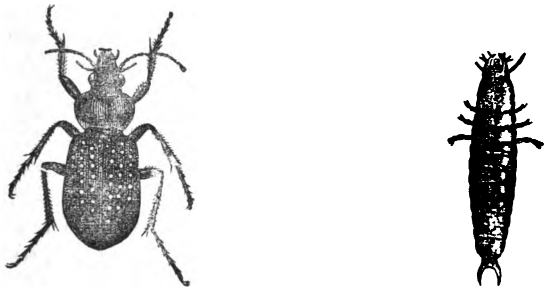


FIG. 2.—*Calosoma calidum:* *a*, the beetle; *b*, the larva. [After Riley.]

FIG. 3.—*Harpalus caliginosus.* [After Riley.]

FIG. 4.—*Posimachus elongatus.* [After Riley.]

THE PALE-COLORED FLEA-BEETLE.

(*Systena blanda.*)

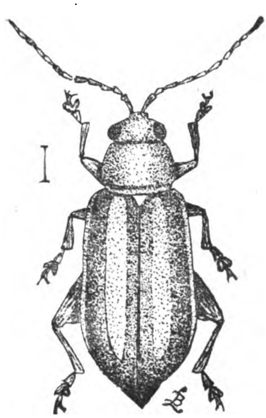


FIG. 5.—The Pale Flea-beetle (*Systena blanda*). [Original.]

This small pale-colored flea-beetle, which is shown in the accompanying illustration (Fig. 5), appears to be the most destructive of all the flea-beetles that are known to attack the beet. It has a rather wide range over the United States. It is found in the New England states, and thence westward to the Dakotas, from which latter point it is exceedingly common southward and westward to California and Arizona.

It is very variable in its color as well as in its sculpturing, some specimens being almost black, while others are nearly yellowish-white, the color of the vittæ or stripes of the elytra. The insect also varies greatly in the amount and manner of its punctuation, from specimens in which this is deep and coarse to others that are almost smooth and glossy.

Its mode of attack is very similar to that of several others of our smaller flea-beetles, *i. e.*, it gnaws the leaves full of holes upon either the upper or lower side. This is done in the beet by the insect eating away the outer parenchyma of the leaf, not reaching quite through, and thereby leaving the plant with a blister-like appearance similar to those affected by one of the diseases known as Leaf-spot or Leaf-blight.

FOOD-PLANTS.

In addition to the beet this Systena has been taken while feeding upon the various species of Amarantus, Chenopodium, Purslane, and white clover. In the latter it gnaws holes clear through the leaves instead of only part way. It also feeds sparingly upon the Cruciferæ.

REMEDIES.

Under the head of remedies against this flea-beetle can be mentioned the kerosene emulsion, and the arsenical sprays. The former has been tried by several of our correspondents with apparently good results. One of them at least wrote that the kerosene emulsion worked perfectly and that none of the beetles were to be seen the next day. If the emulsion did not kill them, it at least drove them away, which is nearly as good. If the insects continue to appear and to attack the plants after the application of the emulsion, and it is not intended to use the tops for stock food, the arsenical spray will be effectual in their removal. No parasites were observed to attack this beetle, nor was it found among the insects contained in the stomachs of birds which have been examined here at the Station to ascertain their food-habits. This does not, however, prove that it is not eaten by the feathered tribe.

OTHER FLEA-BEETLES.

In addition to the flea-beetle just mentioned there have been several others taken while feeding upon the leaves of beets, and of course can be treated here. All of these have similar habits to those of the one just described above, but they vary somewhat in their size and appearance. Several of these are shown in Figs. 6, 7, and 8.

FIG. 6.—The Triangle Flea-beetle (*Disonycha triangularis*). [Original.]

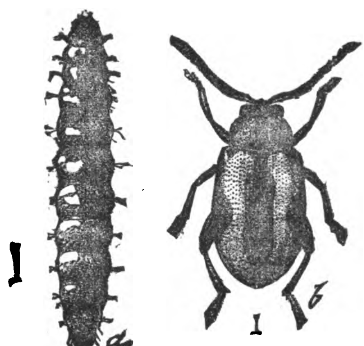


FIG. 7.—Striped Flea-beetle (*Phyllotreta vittata*): *a*, larva; *b*, beetle. [After Riley.]

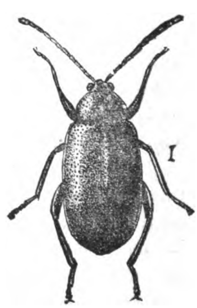


FIG. 8.—*Phyllotreta albionica*. [After Riley.]

The remedies suggested for *tæniata* will also apply to them, should they show a tendency to forsake their more natural food-plants, the various species of Amarantus and Chenopodium, for the beet, or if they come in greater numbers than usual.

BLISTER-BEETLES.

Quite prominent among the insects that destroy the beet here in the west are several species of moderately large soft-bodied beetles that are popularly known as blister-beetles. Four of these insects are shown in Figs. 9 to 12. As a rule they are quite partial in their food habits to the various kinds of plants belonging to the pulse family (Leguminosæ). Nevertheless a number of them have the habit of forsaking these for a large variety of other plants, and especially do they appear to relish garden plants.

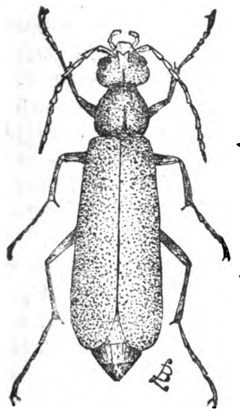


FIG. 9.—The One-colored Blister-beetle (*Macrobasis unicolor*). [Original.]

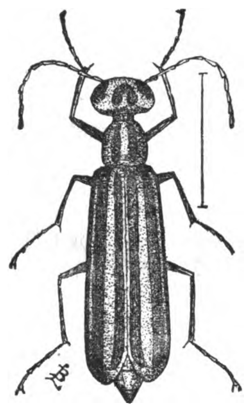


FIG. 10.—The Striped Blister-beetle (*Epicauta vittata*). [Original.]

Like other insects that occur over a rather wide scope of country, and that must necessarily be subjected to great variations of climate, altitude, and abundance or lack of the proper food supply during their period of development, these insects vary greatly in size as well as in color among the different individuals of the same species. Some of them being fully double the size of others.

As a rule, these blister-beetles are gregarious in their habits; and feed in company —sometimes by the thousands. When they gather upon any particular plant or plants they are not long in finishing such portions of it as they can devour. Juicy plants are special favorites of theirs at times, while at other times these are passed by and they seem to prefer just the opposite qualities in their food-plants— just as they are in their comings and goings, so they are in the selection of what they subsist upon as mature insects. They come and go mysteriously, sometimes only as a few stragglers, but more frequently in large swarms. One year they prefer one food plant, and another year another; so that they will include most of our common plants in their bill of fare inside of a dozen years.

While these insects are both interesting and somewhat of a mystery to us as beetles, they are much more so in their preparatory stages. In treating our common gray species (*Epicauta cinerea*) as a tree defoliator, some space was devoted to

the discussion of its early life-history along with that of other species. Since we will always be more or less troubled by these insects as beet pests, I will repeat what I wrote there *

"These blister-beetles are among our most interesting forms of insect life, both as regards their life-histories and their economic importance; and it is quite difficult for us to decide whether their existence is really more of a benefit than a detriment to us, or *vice versa*. They appear during the months of June and July, and are both diurnal and nocturnal in their habits. Professor C. V. Riley, who has been our most energetic American entomologist in working out the life-histories of insects of economic importance, published an account of the life-histories of the present and two other species of the same genus on pages 297 to 302 of the First Report of the United States Entomological Commission. In that work he shows how the eggs are laid, hatch, and the young larvæ, which at first are very active, search for locust or grasshopper eggs upon which they feed. The life-histories of these little triungulins, as they are called, is an interesting one as portrayed by that author, but not more so than are the succeeding stages through which the same insect must pass before it can issue into the world as a full-grown blister-beetle. Were it not for the lack of space, I would quote the author's paper entire. Those who would like to read the account for information can do so by refering to the above named report. In writing a report upon some work that I did for the United States Entomological Commission during the summers of 1880-1 in the Northwest the following language was used:†

"'Until quite recently the larval habits of our various blister-beetles were but little understood. Since the researches of the Commission, however, the preparatory stages of many insects which had hitherto been shrouded in mystery have been ascertained for the first time. Among these were those of quite a number of the *Meloidæ*. It has been ascertained that they feed upon the eggs of locusts, and especially those of *C. spretus* (the Migratory Locust). This, then, accounts for the great numbers of these insects that are found in all the leading locust areas of the West and Northwest, especially in the latter district. Riley has shown in the report for 1878 and 1879‡ the peculiar and interesting feature possessed by the young of some of these insects of protracting development one, two, or even more, years, thereby supplying a new means for the continuation of a species that is dependent upon uncertainties for its continuation among the living.

"'I have noticed a great number of species of these insects both in Montana and Colorado. In Montana they are mostly partial to the *Leguminosæ—Lupinus*, *Astragalus*, etc.—some of which, in certain localities, were covered with these beetles, and denuded of their foliage, thus furnishing an example of an insect that in its preparatory stages is parasitic on another, and that after maturing lives upon a plant not eaten by the insect on which it was a parasite. In this way, then, the parasitic beetle is not only insured of perpetuating its kind through its capability of lying dormant in its imperfect stages for an indefinite time if the necessary amount of food is absent, but also through his choice of food, in its perfect state, since it lives upon that which the locust discards.'"

*Bulletin No. 14 of the Agricultural Experiment Station of Nebraska, pp. 112-114.

†Report United States Entomological Commission. Vol. III, p. 41. [1883.]

‡Report United States Entomological Commission, Vol. II, p. 260; also American Entomologist, Vol. III, p. 196.

REMEDIES.

Considering the usefulness of these insects in their larval stage, and their erratic nature as beetles, it is a question in my mind whether or not it would be a wise thing for us to be too hasty in their destruction. Even should they appear in great numbers and direct their attention to our beets, would it not be the wisest plan to rather drive them away than to kill them? They are very prolific breeders, it is true, and a very few of the beetles will furnish enough eggs for a vast army of the beneficial larvæ. If we have just had a "grasshopper year," or there is a probability of our having one, my advice would be to spare as many of the beetles as possible, at least until after the majority of their eggs have been deposited. The numbers of these beetles is regulated by the amount of food available for the larvæ and not that of the mature insects. Neither birds nor domestic fowls relish them; nor is it a safe plan for persons with soft or tender hands to gather and crush the beetles between their fingers, for, like the "Spanish Fly," these insects are also "blister" makers when handled. If it becomes absolutely necessary that some remedy be applied in order to save the beets from destruction, and the insects cannot be driven away by repeatedly beating them off, they may be readily collected in pans or other receptacles containing a little kerosene or hot water. The plants can also be sprayed with either London purple or Paris green in the proportion of four ounces to the barrel of water.

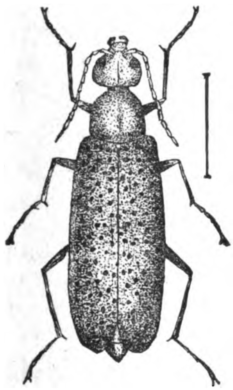


FIG. 11.—The Spotted Blister-beetle (*Epicauta maculata*). [Original.]

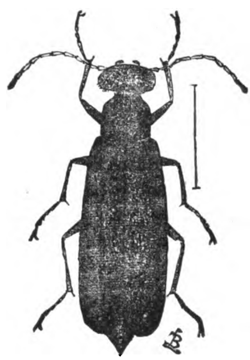


FIG. 12.—The Black Blister-beetle (*Epicauta pennsylvanica*). [Original.]

Thus far, in our studies of beet insects, seven different species of these blister-beetles have been taken on that plant. Of these, Fig. 12 represents the Black Blister-beetle (*Epicauta pennsylcanico*), which is always common on blossoms of the golden rod in late summer and fall. It is also a very frequent enemy of the Tumble and Pig weeds in our fields and gardens. Fig. 11 represents the Spotted Blister-beetle, which is ash-gray and mottled with black. This insect is very partial to the Lamb's-Quarter or White Pig-weed (*Chenopodium album*), and also to the different species of Atriplex. It also occurs on the Grease-wood of the western plains. Fig. 9, the One-colored Blister-beetle (*Macrobasis unicolor*), also a clover insect, is very common in eastern Nebraska. It is grayish-brown in color. Fig. 10 represents what is perhaps our most injurious species of these insects, viz.,

the Striped Blister-beetle, which is yellowish-brown and black. This one is a very destructive potato and tomato pest, and it also feeds quite greedily upon all of the Nightshade family. Besides these, it has been found to attack the Arrow-leaved water lily (*Arum undulata*) here in Nebraska, and sometimes entirely devours them leaf and stem. The Gray Blister-beetle (*Epicauta cinerea*) also occurs upon the beet, but less frequently than the ones just mentioned.

TRUE BUGS.

Some of the true "bugs," *i. e.*, representatives of the order Hemiptera, to which belong the Squash-bug, the Bed-bug, and others, are among the most noted enemies of the sugar and other varieties of beets. There are at least a half dozen different kinds of these bugs that have turned their attention from the weeds upon which they feed to the more promising beet as a steady diet. Four of these bugs are shown in figures 13 to 16 inclusive. All three of these have at various times been mistaken for the much dreaded Chinch-bug, and perhaps for good reasons, too. Like the insect for which they have been mistaken, they very frequently become very numerous and congregate upon various plants in the field and garden. The various weeds have been and now are their characteristic food-plants; but the beet is so closely related to some of these that it is equally attacked by them.

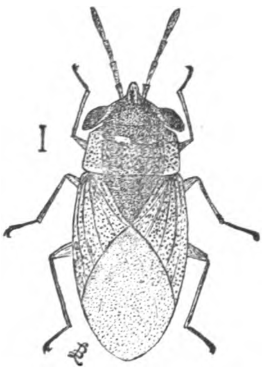


FIG. 13.—Large-eyed Ground-bug (*Geocoris bullata*), enlarged. [Original.]

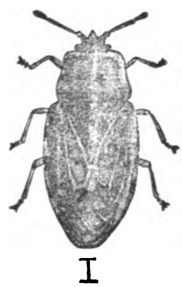


FIG. 14.—Gray Plant-bug (*Piesma cinerea*). [After Riley.]

The one shown in Fig. 13, the Purslane or Large-eyed Ground-bug, as we will call it, is known as *Geocoris bullata* to the entomologist. It is a very common insect in all parts of the region to the eastward of the Rocky mountains and west of the Missouri river. It is especially fond of the Purslane weed, but is by no means confined to this plant for food, since it also occurs on Amarantus, Polygonum, Chenopodium, the "stink" grass, and several other weeds; besides these it frequently attacks grape-vines and small trees in early spring where the weeds are slow in starting. The *Piesma cinerea*, shown in Fig. 14, has similar food habits, but is more partial to the different species of *Amarantus* (Pig-weeds, Tumble-weeds, etc.), than to the Polygonums and grasses. In fact, it seldom touches these latter, nor does it often attack trees, vines, or shrubs. When the beet is in the question they meet on equal terms. A third bug is illustrated at Fig. 16, and is known as *Nysius*

angustatus. This last named bug is more partial to the various cruciferous plants, but also feeds upon the beet.

The ordinary Chinch-bug has also been taken quite often in beet patches, and upon the tops, which they were claimed to have injured.

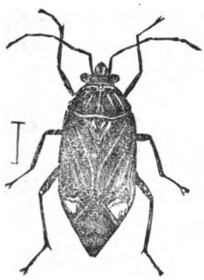


FIG. 15.—Tarnish Plant-bug (*Lygus pratensis.*) [After Riley.]

FIG. 16.—False Chinch-bug (*Nysius angustatus*); mature insect, enlarged. [After Riley.]

REMEDIES.

The most practical and lasting remedy against these bugs is the destruction of their natural food-plants, the different kinds of weeds referred to above. By doing this the insects will never have an opportunity of increasing in injurious numbers. The weeds that are allowed to grow on neglected fields after midsummer are the means of increasing all three of these species. Climate, too, has much influence on these insects; for, with them, as with the Chinch-bug, wet weather is a disaster, while dry weather is a boon.

When present in numbers the kerosene emulsion, so often recommended as a remedy against certain insects, is moderately successful.

LEAF-HOPPERS.

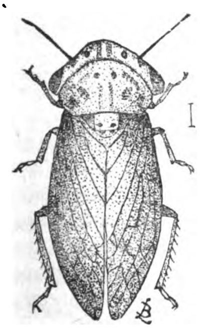


FIG. 17. — Garden Leaf-hopper (*Agalia siccifolia*)—enlarged. [Original.]

Next in abundance, and perhaps in destructiveness, are several species of small insects with sucking mouth-parts. These are to be distinguished from the preceding by their structure and by their powers of jumping or hopping. These little insects are at once recognized by reference to Fig. 17, which represents our commonest leaf-hopper in the garden, where it devotes itself to the various "Pig-weeds" and "Tumble-weeds," which it infests. Its name is *Agalia scicifolia.* While it likes the above named weeds, it also seems to think that the sugar beet is worthy of being added to its bill of fare. This insect is gray, plainly mottled with light brown as shown in the illustration. It is about one-tenth of an inch in length, or as long as the line shown at the side of the figure. Six different ones of these leaf-hoppers were taken on the beet during the past summer.

REMEDY.

When very numerous these leaf-hoppers can be ·ated with kerosene emulsion. The London purple and Paris green remedies will not reach them, since they take their nourishment from the inside of the leaf through their beaks.

CUT-WORMS.

It is needless for me to tell the farmers of Nebraska that cut-worms are among our most dreaded insect pests, for everybody who has tried to raise corn, or garden crops of any description, for several years in succession has had experiences of

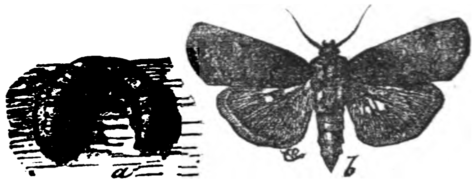


FIG. 18.—Dark-sided Cut-worm (*Agrotis messoria*): *a*, larva; *b*, moth. [After Riley.]

his own concerning their powers of destruction. Several of these cut-worms are shown along with the moths of which they are the young in Figs. 18 to 21.

Some of the different kinds of these "worms" were caught in the very act of cutting off small beet plants during the months of May and June at various points within the state.

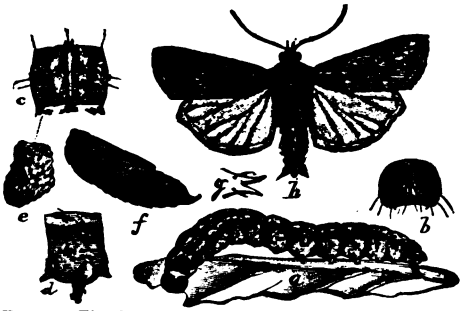


FIG. 19.—The Granulated Cut-worm (*Agrotis annexa*): *a*, larva; *f*, pupa; *h*, moth. [After Riley.]

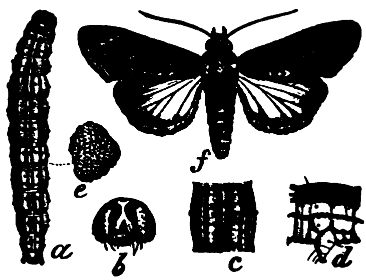


FIG. 20.—The Shagreened Cut-worm (*Agrotis malefida*); *a*, larva; *f*, moth. [After Riley.]

It is not necessary for me to state here that the name "cut-worm" embraces the numerous species of caterpillars that have the habit of concealing themselves during day-time, either beneath some object lying on the ground, or by directly burying themselves just below the surface, and coming forth after night to feed upon various kinds of vegetation. Many of them confine their attacks to garden products and other low succulent plants, but others are known to climb up the trunks of trees, grape vines, and a variety of the taller kinds of vegetation belonging to garden, vineyard, and orchard, where they cause great havoc by eating the buds and tender leaves in early spring. Cut-worms are the young of a certain group of "Owlet" moths, which are also nocturnal in their habits. Both the larvæ and mature insects are, as a rule, inconspicuous in color, being usually dull gray, brown, or black, or have these colors combined.

FIG. 21.—The W-marked Cut-worm (*Agrotis clandestina*)—larva. [After Riley.]

There are upward of three hundred distinct species of cut-worms found within the limits of the United States; and perhaps fully one-third that number occur within our state. While the term is a general one for the caterpillars of moths belonging to several allied genera, we will confine ourselves in the present article to the genus *Agrotis*—a name that signifies rustic, or belonging to the fields—a sort of "granger" as it were! It is the members of this particular genus that are most familiar in Nebraska, and are to be dreaded on account of their depredations on crops of all kinds.

These cut-worms are moderately large, fleshy worms tapering gently towards both ends. When full grown they average from one and one-fourth to one and one-half inches in length, are dull yellowish-white or gray, sometimes inclining to greenish, and clouded and striped or variously marked with dull black or smoky brown; sometimes, though rarely, with deep black and pure white. One of these worms (*Agrotis clandestina*) is figured herewith (Fig. 21), the illustration showing it as curled, a position taken by them when disturbed. This species is about an average size—some species being larger and others smaller than this.

REMEDIES.

It is rather a difficult matter to name any single or even two or three remedies that will apply to all cut-worm depredations. Before the various species had been seperately studied, it was and even now is supposed by many that what is true of one is also true of all species of cut-worms. The different kinds appear at different seasons, and work in different ways, hence must be fought in various ways.

In the garden many of the worms can be taken by supplying artificial hiding places for them in the form of blocks, chips, or boards, which can be examined each morning and the worms crushed. Digging about hills of corn, stalks of cabbage, and tomatoes, and other plants showing recent disturbance, will usually result in the finding of the culprit. Cones of tar paper set about plants will act as safeguards against their attacks, provided the paper projects an inch above ground. Salt is also said to be repulsive to the worms. This latter mode of fighting injurious insects is not to be too highly recommended, since salt is also more or less detrimental to the growth of many kinds of vegetation.

The very best remedy that has thus far been suggested and tried against cut-worms is the use of poisoned grasses, cabbage leaves, or clover. This is done by taking these substances and tying them into loose bunches and then sprinkling them with a solution of Paris green or London purple, say a tablespoonful to a bucket of water. Then in the evening scatter these poisoned baits over the field between the rows of beets, cabbage, etc. The worms will be attracted to them, eat and die. These baits should be renewed several times at intervals of two to four days, according to the state of the weather ond the abundance of the worms.

FIG. 22.—Tachina or Flesh Fly.

All of these cut-worms are attacked by several kinds of parasites, both hymenopterous and dipterous. They are also devoured by a number of predaceous beetles; while birds of many kinds are especially fond of them. One of these dipterous parasites is shown in Fig. 22.

The various insects figured and described in the foregoing pages are all leaf eaters, and feed wholly upon the foliage of the beet, and other plants attacked, or upon those portions above ground.

There are also a few kinds that have been observed to attack the root or that portion in the ground. Among these certain species known as

WIRE-WORMS

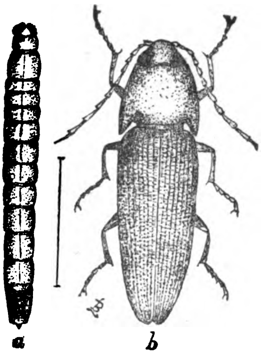


FIG. 23.—The common Snapping-beetle (*Melanotus communis*): *a*, larva; *b*, beetle. [Original.]

are quite prominent in some portions of the state, where they occasionly do considerable injury to the beet as well as a number of other cultivated and wild plants. These "wire-worms" are the young of the various kinds of "Click-beetles" or "Snapping-beetles" so common everywhere, and that are perfectly familiar to every boy. One of these "snapping-beetles" is shown in the accompanying illustration—(Fig. 23, *b*). The larva or "worm" on the right-hand side represents one of the "wire-worms," and probably of the same species as the beetle (*Melanotus communis*). These wire-worms are rather hard, smooth, cylindrical larvæ of a light brownish-yellow or straw-yellow color. They live, as a rule, in the ground, where they feed upon the roots of various plants. In the case of the beet, they sometimes bore into the root, or they eat away the small fibrous rootlets, and in that manner cause the plant to shrivel up and die. Wire-worms are said to be rather long-lived, some of them remaining in that stage for several years.

REMEDIES.

As yet no satisfactory remedy has been discovered for the destruction of the wire-worms on a large scale. But, since they seem to be most abundant on new land, or on such fields as have been in grasses for a few years, they will never be among the species of insects that do the greatest amount of injury to the beet crop.

FOREST PLANTING ON THE PLAINS.

An address delivered before the State Board of Agriculture, at Lincoln, Nebraska, January 20, 1891, by B. E. Fernow, Chief of Forestry Division, Department of Agriculture.

Mr. President, and Gentlemen of the Nebraska State Board of Agriculture: Your indefatigable secretary has been successful in capturing me while I was holding forth in your sister state, Kansas, and although in order to meet you it was necessary to disarrange all preparations for an extended private trip through the Arkansas forests, I am grateful to him for his efforts, as I have long desired to have an opportunity of meeting the tree planters of the west.

Whether the efforts of your secretary in this case will be worthy of your commendation, whether I shall have enough to say of interest to you to justify this special session during your meeting, I must leave for you to judge after you have heard me. At any rate I appear before you as the representative of the department of agriculture at the expressed and urgent desire of the honorable secretary of agriculture, and in conformity with the enlightened policy, under which the attempt is made to establish closer relations and to afford opportunities of personal intercourse between the workers at the department and the workers in the field.

That this policy can only be advantageous to both, that a direct exchange of views, a personal statement and explanation of needs, must be beneficial to the objects, which both have in view, needs no argument.

How desirable it is to supplement in the manner the limited opportunity of reaching the public by the current department publications, I hope to prove to you tonight, for while some of the arguments that I shall put forward have appeared in my annual reports, the opportunity has never been so direct, as in the present case, to place them in the strong light they deserve and to bring them home, to those whom they most concern—to discuss the needs of forestry for your locality in particular.

CAUSE OF TREELESSNESS.

The treelessness of the central plains has been explained by the deficient rainfall and consequent arid conditions of these localities, and until lately it has been doubted, and even now there are people who doubt the possibility of growing trees and forests in those localities without irrigation.

For a large part of this region I do not share these doubts nor do I believe that original aridity alone accounts for the condition in which we find this large region. As everything in nature is the result of a complication of conditions, so we may not dismiss such a phenomenon as a forestless area of several thousand square miles with the simple explanation, that it was too dry for tree growth. The fact that this area is not absolutely treeless goes far to support the proposition that it was not always forestless.

It is not a speculation of curiosity to inquire into the causes of the absence of forests in this region; it is a practical question; for if we understand the causes which produced the present conditions, we have a clew to the means of changing them, we have a basis for our methods in the attempt to reclothe these areas with forest growth.

The entire earth is a potential forest. That is to say, if the interference of animal life and man were excluded in the struggle for existence among the different forms of vegetable life, wherever sufficient depth for its roots exists, and winter cold does not preclude it, arborescent growth would ultimately prevail, on account of the perennial character of this kind of vegetable life and its power to shade out the lower vegetation. In a large part of the world this victory is seen to be attained in a few years, or at least in a lifetime. In other parts it may take geological ages to establish the arborescent growth against the lower vegetation and against unfavorable climatic conditions. These latter parts must be mainly the interiors of large continents and those localities which, for cosmic and orographic reasons, have a climate unfavorable to vegetation in general. This unfavorableness, as a rule, is mainly to be found in moisture conditions, not necessarily deficient rainfall, but an unfavorable balance between the elements of conservation of moisture. In such localities the progress of the forest growth contending for supremacy must be a gradual advance from the more favored border land, but the extension of its area, though slow, is as certain as in the more favored localities where it proceeds rapidly.

But the attack must be all along the line and in close battle front, for the single skirmisher, unless he happens to find a sheltered position, is doomed to death. Where a tree would perish a forest may persist. It is a noticeable fact that the forest to some extent creates its own condition of existence. There is much truth in the poet's expression who speaks of "Africa's arid sand, where nothing grows because it does not rain; and where no rain does fall, because there nothing grows." Only we do not need to rely upon the rainfall alone, but must keep in mind the interdependence of vegetation and general moisture conditions.

It is conceivable, then, that while admitting the unfavorable rainfall conditions in parts of this region as a potent cause in making forest extensions difficult, this extension would yet have taken place if the fire of man with the tramp and browsing of buffalos had not prevented it; or, since the scattered tree growth found on this area suggests that forest growth once existed, it would now exist if fires had not destroyed much of it, thus disturbing the conditions which were favorable to the conservation of the scanty moisture, and reforestation being prevented by continued fires and countless hordes of buffalo.

FOREST COVER AND MOISTURE.

For a large part of this now almost treeless area, moisture conditions will not necessarily be a check to tree growth. We know by experience that a naked soil loses by evaporation more than six times the amount of moisture that it would under the shade of a forest cover. Hence, if we have once established a proper forest cover, namely, effective shading of the ground by either the foliage of the trees or the litter and mulch of decayed leaves, and a check to the sweep of the winds, the amount of water available for the tree growth is increased in proportion. There is some loss, to be sure, but a very small one, due to the interception of the rain

drops by the foliage and even by the forest floor cover, but this loss is compensated again, inasmuch as the presence of this water on the leaves and in the litter reduces the amount of transpiration. What we must never lose sight of is the fact that evaporation is the great dissipator of moisture, and that a dense shady forest growth reduces this evaporation.

I must stop long enough to point out what evaporation means to the arid or subarid, or shall I say in deference to my friends who do not want to be found dry, subhumid regions? If we compare the rainfall during the season of vegetation in the eastern and western stations, it appears that there is not much deficiency, if any, during that season on our western plains, and quite sufficient of evaporation were it not such a rapacious robber. This enormous amount of evaporation is not due so much to heat and direct insolation, but mainly to the constant movement of the air, the incessant winds which take up and disperse the moisture.

From the interesting experiments of the Signal Service, the dependence of the rate of evaporation on the velocity of the wind has been established. With the air at a temperature of 84 degrees, and a relative humidity at 50 per cent, the evaporation under a wind of 5 miles an hour will be 2.2 times as rapid as in the calm air; at 10 miles, 3.8 times; at 15 miles, 4.9 times; at 20 miles, 5.7 times; and with a wind at 25 miles' velocity the rate of evaporation will be 6.1 times as great as in calm air. And as the average velocity of the wind on the plains may be set down as 12 miles an hour, there is probably at least four times as much water evaporated and dissipated as where the winds are checked. Hence, the value of the windbreak, which reduces both the evaporation from the soil and the transpiration from the plant; for transpiration is also accelerated by the motion of the plant under the influence of wind.

We come, then, to the conclusion that it is not deficiency of rainfall so much as rapidity of evaporation due to the unchecked winds that is detrimental to plant growth on most parts of the plains region. What do we learn from these considerations to help us in forest planting on the plains? Plainly this:

1. That forest plantations in large blocks have more chance of success than small clumps of single trees, since such large plantations alone are capable of becoming self-sustaining and of improving their conditions of growth by their own influence upon moisture conditions of the soil and air.

2. That we must not only plant densely—much more densely than is the common practice—but in the selection of kinds give predominance to such as are capable of quickly and persistently shading the ground, creating an undergrowth and cover that will prevent evaporation, and thus make the growing of the light-foliaged, quick-growing, valuable timbers possible.

NEED OF CO-OPERATIVE ACTION.

I cannot here refrain from expressing my sympathy for those in the front, who struggle to conquer single-handed these vast and fertile but climatically ill-favored regions. While their reclamation certainly does not appear to me an impossible undertaking, it seems almost hopeless to expect it from the pigmy efforts of the pioneer settler, lost almost in this endless treelessness.

Without means, without knowledge, without a systematic organization, without a well conceived methodically executed plan, without co-operative effort in close battle in front, victory, if attainable, must be bought by many repulses, disap-

pointments, failures, and even those that might gain a firm foothold may, in the end, succumb, because their neighbors failed to support their flanks.

I believe that forest planting is one of the necessary requisites to permanently reclaiming this vast domain; I believe that reforesting this large area, deforested by fire, buffalo, and consequent desiccation, is not impossible. But I also believe that success can be forced only by co-operation, by strong hands working together upon a comprehensive plan on a large scale, systematically and methodically carried out by commanding knowledge, means, and power, such as alone a government —be it state or general government—can command. The present plan of allowing the skirmishers to waste their energy, their lives, is cruelty and bad generalship.

HOW TO PLANT.

Chapters and books might be written on the proper methods of forest planting on the plains. I shall confine myself to only one chapter, and give of this only the merest synopsis, namely, the one on the selection of species for planting, with reference to the preservation of soil humidity. For in this chapter we learn the difference between tree-planting and forest-planting; a difference which I fear has not found much consideration by nurserymen and planters.

To establish forest conditions must be the first aim of the planter.

Forest conditions, as we find them in the natural forest, consist in the dense growth, mixed growth, undergrowth. By so much as any one of these conditions is deficient or lacking, by so much is the forest short of the ideal. Reduced evaporation is forest condition. Shade reduces evaporation. Dense growth furnishes not only straight clear timber but shade. Mixed growth alone can preserve a continuous shade for a long time. Undergrowth assists in keeping the ground shaded.

The forest planter, then, may learn a lesson from Nature in recognizing these conditions as desirable ones and worthy of imitation; but we will also not forget that man is wiser than Nature; that he works with an object; that he must intelligently improve on Nature's methods to reach his end, which is the economical production of material or conditions. The value of time, which is no factor in Nature's calculations; the value of land, of which Nature has an abundance, make it necessary for man to intensify his methods. Thus he will reduce the dense growth from the maximum of Nature's planting to the optimum of most rapid and plentiful production; he will substitute for the chance mixture of species, which in the natural forest is the result of a free fight for existence among the different occupants of the ground, a combination which is chosen with intelligence and to produce the most desirable results in the shortest time.

In this selection from among the species which are capable of thriving in this locality and soil, and which are yielding the most desirable material, three points must guide the planter:

1. Their relative capacity for preserving and increasing favorable conditions.
2. Their relative dependence for development on light and shade.
3. Their relative rate of height-growth.

RELATION OF TREE-GROWTH TO HEIGHT.

The first point is possessed in the highest degree by the evergreens and by those trees which have a dense foliage and preserve it dense through all time. There are

not many of these, for a large number which in their younger years have a full foliage thin out with increasing age. Besides, by the suppression of the lower branches, which are not capable of living under the shade of the crown, the latter is removed farther and farther from the soil; and sideways crowding also kills out many individuals; so that with all this, sooner or later (according to species and soil conditions), the crown cover is more or less broken, and weed growth, rapid humification of the litter, and increased evaporation is the consequence; *vide* all the cottonwood plantations outside of the wet bottoms. The same deterioration of the soil will be noticed under the ash and the black walnut, which thin out rapidly. Soil conditions will, to be sure, modify this capacity of retaining a dense foliage, and on a fresh deep soil even the thinly-foliaged trees will carry a fuller head.

It is a matter of observation that, as a rule, the trees which preserve a full dense crown are the ones which are capable of thriving under shade, or at least with less light than the thinly-foliaged ones; thus, a yew, a spruce, a box-elder, a beech will thrive under shade where a pine, a birch, or a locust can hardly exist. There are some exceptions, and some of the thinly-foliaged trees, like the oak, can vegetate though not thrive under the shade of some "foregrown" tree. In fact, one may, according to the different degree of light which is necessary for a thrifty development, range the species so that those at the top of the scale may be called light-needing, and those toward the bottom shade-enduring.

I do not want to be understood that any of our forest trees thrive better for being shaded. Excepting in their earliest stages, when protection against heat and cold, rapid evaporation and transpiration, is needed by some, they all grow best in full enjoyment of sunlight; in fact, the rapidity of their development is a function of the amount of foliage which is at work, and this again depends upon the amount of sunlight at its disposal. But some can get along with less sunlight; they can endure without much detriment a more or less dense shade for a longer or shorter period, while others, under the influence of their own crown even, thin out soon, and, if shaded by neighbors, are arrested in their growth and killed sooner or later. The time when the influence of light conditions is most potent varies with different species and according to the site, so that, for instance, on a rich moist soil a light-needing species, like the birch, will endure for a long time considerable shade, which on a poorer soil would have proved detrimental.

As a rule you will not find among the undergrowth of our forests any species that is a light-needing one. Hence, culling any of our thinly-foliaged light-needing trees, such as the white oak or tulip tree, means killing it out, since it cannot reproduce itself and thrive in the shade of its foregrown companions.

It is evident that favorable soil conditions can be preserved only by a persistent close crown cover such as the leafy species furnish. It is, however, not necessary that the crowns should all be on the same level—all of one story, so to speak; on the contrary, a denser cover can be attained if individual trees or groups of varying heights are placed together. Here then comes in the consideration of the relative rate of height growth. And it is an important one when we select a mixture or combination; for if we were to place together on an equal footing a light-needing with a shade-enduring kind, of which the latter is a more rapid grower, the former would soon be killed out. Now, as a rule, the light-needing species—but by no means all—are at first more rapid growers in height than the shade-endur-

ing; but what they gain in initial rapidity they lose in persistency, that is to say, they do not grow to as great a height as the leafy kinds, or at least after the first period of rapid growth they grow only slowly.

Each species has its characteristic curve of height growth, characteristic especially in regard to the beginning of rapid ascent, to the position of the points at which the rates of growth change, and to the point of culmination. This curve is, of course, modified for each species according to the site upon which it grows. But as it is possible to construct a scale in which the various species can be ranged according to their relative capacity of shade-endurance, so for given conditions and periods of growth they can be ranged in regard to their relative rate of height growth. In this way I have, for instance, ranged twelve kinds that are used in prairie planting according to their shade-endurance and their rate of height growth during their youth:

As to shade:	As to rate of height growth:
1. Box-elder.	1. Cottonwood.
2. Mulberry(?).	2. Soft Maple.
3. Elm.	3. Elm.
4. Black Cherry.	4. Locust.
5. Osage Orange.	5. Honey Locust.
6. Catalpa.	6. Black Cherry.
7. Soft Maple.	7. Catalpa.
8. Locust.	8. Osage Orange.
9. Honey Locust.	9. Box-elder.
10. Black Walnut.	10. Black Walnut (?).
11. Ash.	11. Ash.
12. Cottonwood.	12. Mulberry (?).

This is not an immutable scale but only a tentative proposition, in which the kinds placed widely apart will alone really retain their relative positions. We will find at the top of the first scale the most shade-enduring and at the head of the second scale the most rapid growers among these named. If we can make, therefore, a combination of these, we will succeed in obtaining the two points to be gained, the densest crown cover in varying tiers, and the light-needing kinds overgrowing the shade-enduring, which allows the largest number of individuals on the area.

I must once more guard you against accepting the above scale as definitely correct. Many conditions of soil and climate modify the behavior of trees. For instance the Black Walnut has a tolerably dense foliage when quite young, but except on rich bottom lands, it thins out very soon and, since it leaves out late in the season and loses its foliage early in the fall, it must be considered as one of those which do not furnish desirable shade conditions. In regard to its height growth too it may vary; but as far as my observations go, while it shoots up rapidly at first, it almost stops growing when twelve or fifteen years old in the prairie. On the whole we must study the behavior of our trees still further, before we can speak with assurance as to the best selection and combination. But we can formulate the principles upon which proper selection and combination rests, and having then concluded never to plant one kind by itself—which is the unfortunate practice in most prairie planting—nor to plant several species in combination without

knowing why they should be combined, we can lay down the following rules for making the selection:

HOW TO MIX.

Rule 1. The main growth, *i. e.*, the one that occupies the larger part of the ground must be of a kind that improves soil conditions, namely, a densely foliaged shade-enduring kind, which does not lose its shading capacity with age.

Rule 2. Densely foliaged kinds may be grouped together, if the slow grower will endure the shade of the rapid grower, or can be protected against its supremacy by being planted in larger specimens, or in advance of the former, or in larger numbers; or if its gradual killing out after it has served its function of soil cover is not objected to.

Rule 3. Sparsely foliaged kinds should never be grouped together where soil humidity is to be preserved, unless no leafy tree can be found to fit the locality.

Rule 4. In grouping light-needing with shade-enduring kinds, the former must be more rapid growers or must otherwise be given an advantage.

Rule 5. The mixing in of the sparsely foliaged trees is preferably done singly and not in groups, unless special soil conditions necessitate the latter method.

With such rules and considerations in mind, the proper practice in prairie planting is indicated.

The first and main object to be attained there is to create a soil cover. In Russia, under very similar conditions to those of our prairies, it has become the practice to first plant a shrub of little or no value—a low willow (*Salix pruinosa*)—as a first soil cover or undergrowth, into which the desirable forest trees are planted afterwards. As this can only be done by hand labor it is not a suitable practice for our conditions, We might use the common Bullberry (*Thepherdia argentea*) for such an undershrub, or the Sand plum, which I know has done good service as undergrowth. But we have, in the Box-elder or Russian Mulberry or Osage Orange, sufficiently hardy and shady kinds and not entirely devoid of value for their wood, that can be used for the purpose. Of these not less than 6,000 to 8,000 plants should be set to the acre, making rows three feet apart and two feet in the row; even 10,000 would not be too many, for rapid shading of the ground from the influence of sun and wind is the key to success.

Any more valuable timber that is to be planted must be as fast a grower as, or faster than the underwood, and can be introduced at the same time, setting the plants in the same rows, at the ratio of not more than 200 to 300—or every twelve to fifteen feet—alternating in the rows. For this planting the very best rooted stock should be chosen: Locust, Honey Locust, Catalpa, and the Oaks; and special care taken in planting it. In deeper specially favorable situations, the Black Walnut would answer for this selection. The Black Cherry also promises to be a most valuable addition. Of course a great many variations may be suggested.

CONIFERS.

Of all trees, the most suitable for prairie planting and for planting in the dry plains are beyond doubt the conifers, and especially, the pines.

There are two reasons why they should be chosen preferably to others. First of all they furnish not only a denser cover, horizontal and vertical, but a cover all the year around, being evergreen. Secondly, they require less water, from one-sixth to

one-tenth of what most deciduous trees transpire, and are, therefore, less liable to succumb to drought. In winter they will hold the snow more efficiently than the naked leafless kinds, thus preserving the moisture on the ground.

Nature has given us indications in that direction. The driest soils everywhere are occupied by the pines, and the arid slopes of the Rocky mountains and the interior basin support only conifers, especially Pines and Juniper. From Professor Bessey I learned only today, that my theory regarding the former forest cover of the plains is born out of the discovery of pine forests buried in the sand hills of northern Nebraska and that he found the same kind of pine naturally growing in eastern Nebraska which covers the Black Hills and Rocky mountain slopes, namely, the Bull Pine (*Pinus ponderosa*).

I am also assured that in artificial plantings, after the pines are once established, they rarely succumb to the ills of climate in Nebraska; and I have certainly seen young seedlings of the Bull Pine thrive most wonderfully in a dense growth of weeds and grass at Franklin, Neb., where Mr. C. S. Harrison is the pioneer of conifer growers.

The difficulty in their use lies in starting the plants; for as little seedlings they are remarkably tender, especially as regards light conditions. Under strong light, their foliage transpires moisture faster than their roots can supply. On the other hand, if left in the nursery until they have developed the strong root system they need, difficulty in transplanting is experienced, and the greatest pains must be taken not only to preserve the roots uninjured, but to bring them into the ground before they have a chance of drying out.

Yet, I believe, all pains in this respect will be crowned by success, and if I were to direct planting in Nebraska, I should largely use the Bull, the Scotch, the Austrian Pines with the Douglas Spruce; and for undergrowth, the hardy and shady Juniper; the Scotch and the Austrian Pines mainly because they can be had more cheaply than the others and because so far they have been tried the longest with assured success. This list may no doubt be extended to others.

METHODS OF PLANTING.

One word as to the method of planting. I do not think that we have by any means found the best, cheapest and surest way of planting, and experiment in that direction would pay. The well recommended method of breaking the prairie in June and plowing thoroughly in the fall for planting in the following spring, is open to several objections, among which not the least is the time and expense of this cultivation.

I should propose, for trial, to simply break the sod in June and sow millet thickly to make a close stand; this will secure a return for the labor of breaking. The millet should be cut with a high stubble, which may be expected to catch the winter snow, keep down weed growth, and act as mulching the next season.

Plant next spring as early as possible, in trenches, without disturbing the intermediate space, and, most likely, cultivation will not be necessary the first season, while the second season, with our dense planting, the trees should be able to help themselves. In this manner I would expect to reduce the work and also to reduce evaporation and to secure the maximum of moisture in the trenches where it is most needed. Certainly systematic experiments in the method of forest planting are now even more needed than in the selection of trees.

The mechanical tree-planter, of which I exhibit an illustration, has proved that you can go on the raw prairie even and start a successful plantation by setting the trees in trenches, leaving the rest of the ground undisturbed, the precipitation draining into the trenches.

FOREST PLANTING A WORK OF INTERNAL IMPROVEMENT.

I do not wish to conclude without suggesting some practical application of my remarks, which it would be well for such a body as your State Board to consider.

If I am right in believing the establishment of forest belts in your state an indispensable aid to permanently successful agriculture; if I am right in assuming private efforts in this direction unavailing or at least accompanied by much waste of energy and time; if the climatic amelioration which comes from a systematic disposal of such forest areas is a matter which concerns the general welfare of your state, then I contend that it must be a work of internal improvement, which it is the duty and function of the state to undertake.

It may not be the present policy of the state of Nebraska to look after the needs of internal improvement—even the United States does but little in that direction—but the time is not far distant when we shall have a higher conception of the functions of the state than to consider it merely a policeman, when the state, the co-operative association of all citizens, will do whatever is desirable for the general welfare and what, if left to private enterprise, is not done because impossible for the single individual or directly unprofitable, or leading to undesirable monopolies.

Forest planting for climatic amelioration in Nebraska will eventually be one of those public works, and your State Board could even now do nothing better for forestry than to formulate and advocate a plan for public forest planting. Such work, such state action, I do not conceive to be carried out on the "paternal" plan, although even this would be better than the present inactivity, but it can be carried out on pure business principles.

After the general plan has been elaborated, let each county, by a commission of competent men, designate the areas that ought to be put into forest, and the areas should be as far as possible non-agricultural, the poorest soils; let the state exercise its right of eminent domain and withdraw such lands temporarily from the ownership of the individual for purposes of public utility and transfer it to the county, the latter taxing itself for the interest and funding charges on this expenditure as also on the expenditures by the state for planting, etc.

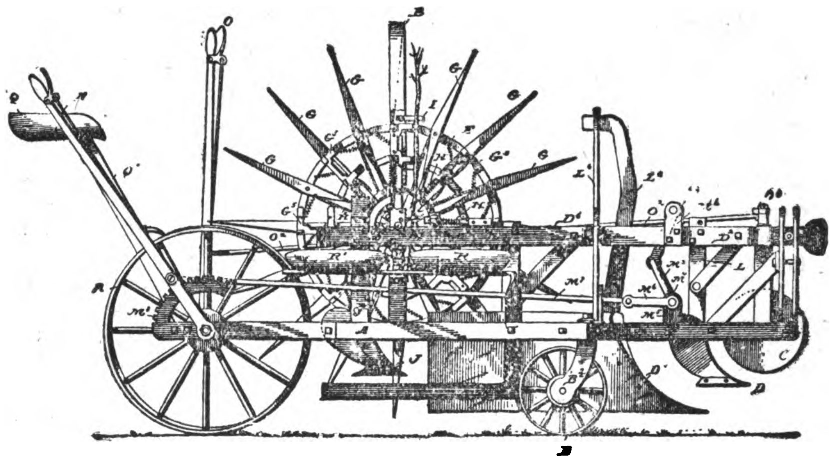
Where the county is still too thinly settled to sustain such a charge, the state may well distribute the interest and funding charges in such a manner, that they are made proportionate to increasing population.

Let the state, by its own officers under direction of the State Board or other control, or else by contract with private parties, establish an efficient forest cover. The state can command the necessary funds probably at five or six per cent, while the private individual must pay from ten to twenty per cent; the state engaged in this enterprise on a large scale, can also do the planting, etc., more cheaply and more efficiently.

After ten or fifteen years, when the plantations have become self-supporting and begin to yield valuable material, the former owner of the land or his successor may be given opportunity of reclaiming his property by repaying price received for the

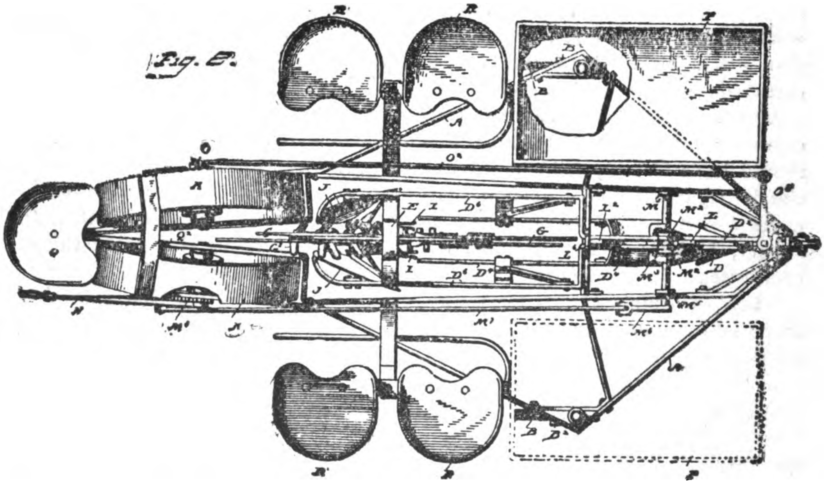
land with interest and cost of plantation, less share of the taxes paid toward the forest improvement fund; submitting, however, in the use of the forest growth to such regulations as seem necessary to insure its continued value as a cover.

Fig. 1.



By some such plan, in which I cannot see anything impracticable, the advantages of co-operation and state credit are secured and yet those who are directly benefited have paid for it, at the lowest rate, however.

Fig. 2.



What I have seen of the enterprising spirit in your state, and especially what I have heard of the management of your Board this afternoon, has inspired me with the belief that it is not chimerical to expect action of this kind from your public spirit. To show you my gratification at the cordial reception you have accorded me, and as an expression of my interest in the welfare of your state, I desire to

offer such practical aid toward the proposed "forest improvement plan" as I may. You have, of course, a right, through the secretary, to command my expert advice as an officer of the department of agriculture, but I tender you, in addition, as a private citizen, free of charge, the use of a patent, which I own in part and which would be of no small value in making forest planting on a large scale practicable.

It is a tree-planting machine, capable of preparing the ground and planting in one motion 20,000 trees per day; the invention of one of your own citizens, tested and found efficient in your own state at Stratton.

I furnished the money to obtain the patents for one-half interest in the invention. As far as this interest goes, I am willing to give it up to the state of Nebraska, if your Board will formulate and the state undertake a plan of forest planting for climatic amelioration as a public work of internal improvement.

The machine is drawn by five horses abreast. The coulter and coulter-plow (C and D) cut the prairie sod in advance of the large furrow-plow (D^4) which opens a furrow six inches wide (or wider if wanted) and from ten to fifteen inches deep, the depth being regulated by means of a lever (N) operated by the driver, and the furrow being kept open by extension of the landsides. By the side of the planting-wheel, which is propelled by walking on the ground as the machine moves (walking sticks, G), are seats for the feeders (R and R^1) and by their side are boxes for carrying plant material (P) enough to plant a row half a mile long, four feet apart. The plants are fed to automatically acting grapples or clamps (G^3) attached to the planting-wheel. The distance of the plants is regulated by the number of grapples on the planting-wheel which are being used. In the new machine, the grapples on each spoke, which are to receive the plants, are kept open by means of a disk and springs until they pass a given point on the upper side of the wheel; before this is reached the plant is inserted with the roots pointing upwards into a holder (I) where it is found by the grapple which takes it up and closes, holding the plant until it is brought around and down into the furrow, when the grapple opens

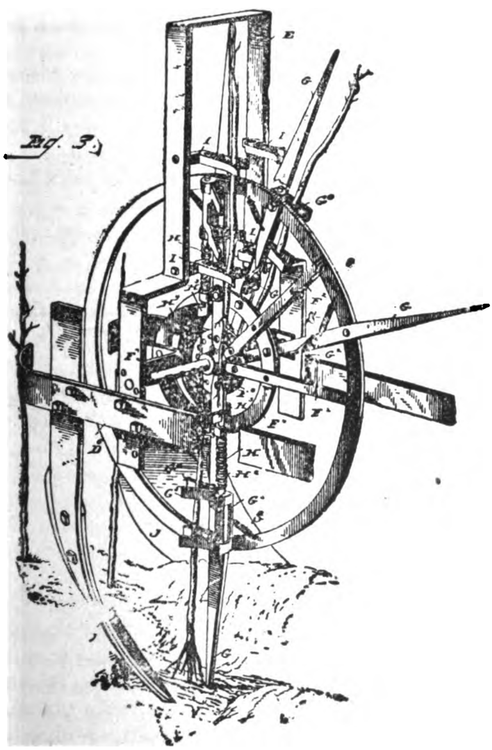


Fig. 3.

automatically and drops the tree. At that moment two shovels (J), following closely, fill soil around the plant and close the furrow. The hind wheels represent two six-inch-face rollers, set somewhat obliquely to press the earth firmly against the plants. The superior success of the planting by this machine on raw prairie as against ordinary methods on prepared ground, which has been observed, must be ascribed to these rollers, which bring roots and soil in closest contact, the most essential requisite in tree planting, most especially in a dry climate.

SILTING, OR BASIN IRRIGATION.

REPORT OF THE GEOLOGIST, PROF. L. E. HICKS.

The effect of river silt to enrich the soil is a fact of common observation, and has been known from the earliest ages. Bottom lands are, as a general rule, rich lands, because they are built up by river silt or sediment, and are still frequently fertilized by the slime which settles from waters spreading over them in times of flood. This indisputable and well known fact should teach us a lesson. *Nature's best fertilizer is water, and the matter mechanically suspended in water.*

Water is the best of fertilizers, because fully three-fourths of the weight of ordinary plants is water. A fertilizer of any kind must contain the elements which the plant needs to build into its tissues, and as these are chiefly water, the need of this element is primary and imperative. Moreover, every other kind of plant-food must be conveyed by means of water to the tissues where it is needed. Water is the common carrier of the whole physiological system. Water dissolves the plant-food in the soil and carries it to the tissues where it is utilized. Not only is water the common carrier of plant-food from soil to plant, and from cell to cell, from root to branch, within the plant, till every organ, every petal and leaf tip is fed and nourished; but it is also the common carrier and distributer of fertilizing elements over the surface of the earth. From bleak mountain heights water transports mineral and organic matter to enrich the valleys. On the balance sheet of human profit and loss this is a distinct and important gain.

But from rich valleys and plains water also carries away into the sea millions of tons of the best plant-food every year. This is just so much loss and damage, so far as the habitableness and fertility of the earth in this present geological epoch are concerned. Possibly in some far distant epoch, when the present sea floors are converted into dry land, the wealth now being carried there by rivers will bloom out in green fields and lowing herds, filling with joy the heart of the millennial granger, and his pockets with gold. But that possibility is not of much interest to us in this generation. If we can arrest some of that wealth on its way to the sea, it will go down very smoothly into our own pockets, and rest there without arousing any conscientious scruples about robbing the aforesaid hypothetical millennial granger.

BASIN IRRIGATION IN EGYPT.

In one country the notion of arresting the seaward stream of rich plant-food, and spreading it over the land, has not only been entertained as a possibility, but has been reduced to practice ages ago. Probably the earliest systematic efforts to imitate the fertilizing processes of nature by artificial flooding were made in the valley of the Nile; and it is there that we still find the classical example of the

benefits of "Basin Irrigation." It is, perhaps, the common opinion that the far-famed fruitfulness of Egypt is due to the natural inundation of the soil by the sacred river. However true that may have been in primitive times, it is not true now, nor has it been true for immemorial ages. Man no longer trusts nature with the work, though nature gave the first hint how it might be done. Instead of leaving the precious flood waters to spread over the valley at their own sweet will, they are shut up in artificial canals and guided to selected fields. The lands of Egypt are divided off into separate basins by means of artificial dikes. Each canal supplies a series of these basins and returns the clear water to the river, after the fertilizing mud has been deposited upon the fields. Solidly built sluiceways with movable gates permit the water to pass from one basin to another, and from the last basin into the Nile. These basins are kept covered with water for forty days to the depth of from three to ten feet. Upon the slime remaining after the water has been withdrawn the crops are sown without any further preparation of the soil.

The whole operation is artificially regulated with the utmost care and exactness. Left to the unregulated natural process of flooding Egypt would not produce more than a tithe of its present harvests.

The average size of the basins is 9,000 acres. The largest basin (Delgawi) contains 48,000 acres, and the smallest (Maasra) contains 500 acres. There are in Upper Egypt 103 basins, containing 1,174,022 acres, on the left bank of the Nile; and sixty-two basins, containing 288,392 acres, on the right bank; in all 1,462,414 acres in 165 basins. The average amount of water put on each acre annually is 147,000 cubic feet. This gives us for the duty of water 214 acres to the cubic foot per second. This irrigation costs an average of $13.75 per acre annually. All other expenses, including seed, sowing, cultivating, harvesting, and marketing the crop, $14.60 per acre. The crop is worth $87.25 per acre, leaving a net profit of $58.90 per acre. Basin irrigation pays in Egypt.

Another application of the principle of basin irrigation is the reclamation of salt plains and alkali lands. The alkaline carbonates and other injurious salts are soluble in water, and the thorough and continued washing which the soil receives in the process of basin irrigation dilutes these salts to such an extent that they become harmless. It is the concentration of alkaline solutions by evaporation that makes the land alkaline. Flooding reverses this process, converts the concentrated solution into a dilute solution, most of which is drawn off with the water, and thus the soil is sweetened, cured of its alkaline bitterness, and restored to fertility.

In contrast with these beneficial effects of basin irrigation in sweetening the soil, the example of Lower Egypt, showing as it does the injurious effects of a different system, presents an instructive lesson and warning. In ancient times, and until the year 1820 A. D., basin irrigation was practiced in Lower as well as in Upper Egypt. Mehemet Ali Pasha changed the whole system from basin irrigation, in which water is put on the fields in the non-growing season, to ordinary summer irrigation, in which system water is supplied to the crop as it grows. His chief motive was to introduce the cultivation of cotton, and thereby to increase the revenues of the government. This he accomplished as an immediate result, but the remote consequences were not so fortunate. Since the fertilizing deposit of Nile mud upon the lands of Lower Egypt has ceased, and the thorough washing of the

soil involved in basin irrigation has also ceased, the fields have become poorer and more alkaline year by year. Considerable tracts are already abandoned. The only thing which will save Lower Egypt from utter sterility is to return to the ancient system of basin irrigation.

In Europe also basin irrigation is practiced, but under a somewhat different form known as "Silting," or "Warping." I quote from Scott's "Irrigation and Water Supply."

"WARPING OR SILTING.

"This species of irrigation consists in repeatedly flooding low lying tidal or river lands, and allowing a succession of sediments to be deposited. Sometimes the object is only to fertilize the lands, but more generally it is practiced with the double purpose of fertilizing and of raising the surface of low or swampy ground. In either case warping depends for its effect upon the presence of much suspended alluvial matter in the water used. In this way the thinnest and poorest soils, if favorably situated, may be covered with the richest alluvium to almost any depth.

"Warping is effected by a cut or canal from the sea or river with sluices for the admission and discharge of the water, which is confined to the grounds intended to be warped by surrounding banks raised to the required height. The higher the banks and the deeper the sheet of water that can be impounded the better, since a greater burden of sediment will be deposited; but the height of the bank is, of course, limited by the difference in level between the land surface and the water in the canal.

"It is easy to understand the effects of adding to any soil large quantities of fertilizing mud. Herepath has calculated that, in one particular instance, the quantity of phosphoric acid brought by warping upon an acre of land exceeded seven tons. Moreover, since the matters deposited are all in a low state of division, they must exist in a condition peculiarly favorable to the plant. The fertility of warped lands is so great that they have been known to yield full crops for fifteen or even twenty years in succession without manure. There can be no doubt, however, that the warp of some rivers is much more valuable than that of others. The value must depend upon a variety of circumstances, such as the quantity of valuable ingredients contained in the mud, and the proportion of the several ingredients. The presence of any one useful or essential ingredient must add value to the warp, and the greater the proportion of all of them the more valuable will be the deposit.

"Mr. Moncrief* gives an example of this work having been carried on with great success near Avignon, by means of the water of the Crillon canal. M. Thomas, a merchant of that city, having a property composed of gravel and stones, and fit only for for grass crops, laid some of it out in terraces and obtained the use of fourteen cubic feet per second of water from the Crillon canal, which he turned upon it for the four winter months of every year. After three years he found that he had covered an area of 22.2 acres with a coating of the finest alluvial matter, from twenty to twenty-seven inches thick. The cost of the operation, including a water rent of sixteen shillings, was just seven pounds sterling ($35) per acre. The land, which before had been worth $97 per acre, was valued at $566 per acre, and yielded seven or eight crops of wheat without requiring any further manure,

* "Irrigation in Southern Europe."

"The expense of warping has been variously stated at from $7.50 to $50 per acre. In ordinary circumstances it can seldom cost more than the smaller sum, as after the banks and sluices are fixed, which outlay cannot be wholly charged upon the warping, the only expense will be the occasional wages of a man to attend the sluices. On the other hand, poor land has been so raised in value by this outlay as in many cases to repay the cost in a single year." *

It would be a waste of time, or, at best, only a matter of curious interest to the scholar or economist, to cite these processes and profits of basin irrigation in other parts of the world, if there were no possibility of applying the system in Nebraska. If, on the other hand, this method may be applied here, it becomes at once not only a practical matter, but possibly a very important resource for increasing the agricultural production of this commonwealth. The answer to that "if," that is to say, the determination of the value of basin irrigation in Nebraska can be made final and absolute only by actual trial. But some light may be thrown upon it in advance of the practical test in the field, by passing in review some of the physical peculiarities of the plains which lie at the eastern base of the Rocky mountains.

DIFFERENT TYPES OF RIVERS.

Among the remarkable features of these plains one of the most noteworthy is the peculiar character of the rivers. They belong to a new and distinct type. If we should attempt to classify and describe them with reference to the definitions and divisions given in the old text-books of physical geography we should soon find that the principles and definitions there laid down are not applicable to the case in hand. New principles of classification must be sought, for the facts are different from those upon which the old classification was based. The text-books tell us that a typical river has three recognizable parts, the upper, middle, and lower courses. The upper course lies among the hills or mountains. It is characterized by steep gradient, swift current, and occasional rapids or cascades. The valley is narrow and V-shaped. Erosion is active, especially at the bottom, thus constantly deepening the valley. If there is any deposit of sediment in the upper course, it is slight and temporary, soon again to be torn down and swept away by the swift current. The changes of direction are angular and abrupt, instead of long, sweeping curves, giving a zigzag line in which sharp turns alternate with straight reaches of considerable length.

The middle course extends through plains of moderate elevation to the lowlands near the sea. In comparison with the upper course, it has a low gradient and a gentle current. The valley is broadly U-shaped. Erosion is less active, and is expended upon the sides rather than the bottom of the valley. A far greater amount of sediment is deposited, and instead of being speedily carried away it forms a distinct and rather a permanent feature of the middle course, namely, the flood-plain, or the bottom land. This is somewhat increased in height and greatly enriched by the silt deposited upon it during each flood. In many cases remnants of an older flood-plain, or of a series of such older flood-plains, form terraces, or second and third bottoms. These possess nearly all the fertility of the present flood-plain without the disadvantage of being still subject to overflow by the waters of the river. The changes of direction in the channel are accomplished by broad and

* "Irrigation and Water Supply," by John Scott; London, 1889; pp. 82–86.

sweeping curves, which extend themselves always on the outer or convex side, till, at length a loop is formed, almost returning upon itself. The narrow neck of the loop is liable to be breached whenever the stream is a little more than bank full, thus leaving a long curve to be silted up, or to form a "horseshoe pond."

Such old abandoned channels are still more common in the lower course, which, as compared with the middle course, has its channel yet more meandering and rapidly shifting, lower gradient, and broader flood-plain. Deposition is here at the maximum and erosion at the minimum.

But if we take this conception of a river with its three distinct courses and attempt to fit it, or any part of it, upon the rivers of the treeless belt, we shall at once discover that it is a misfit. No such distinction of courses can be recognized. Neither the whole course nor any portion of our rivers corresponds to any one of the three courses. Furthermore, this does not arise from the fact that our rivers are only tributaries to other rivers. The fact that they do not flow into the sea, but into another stream, would readily account for the absence of a distinct lower course, but not for the lack of correspondence with the upper or middle course of a typical river. Small tributary streams usually show the characteristics of the upper course, and larger tributaries include elements belonging to the middle course also. The rivers of western Nebraska have some of the characteristics of the upper and middle course, more of the latter than of the former; but they are so strikingly different from either, in some respects, that new principles of classification must be sought.

The Loup rivers are typical rivers of the plains, and illustrate the difficulty of applying the old forms of classification. They have neither an upper course nor a lower course corresponding with the definition. There is a closer correspondence with the definition of a middle course, with, however, this significant exception, *the absence of any distinct flood-plain.* Small tracts are subject to overflow, but, compared with the size of the river, and the length and breadth of its valley, they are quite too insignificant to be called a flood-plain. The typical flood-plain is a good broad strip of land extending continuously along the channel, sometimes on one side, sometimes on the other, sometimes having a good breadth on both sides at once. A most striking peculiarity of its surface is that it slopes away from the stream towards the bluffs. This arises from the fact that in times of flood the greater bulk of silt is thrown down near the channel, thus building up its banks higher than the strip of land between them and the bluffs. The Loup rivers have no such typical flood-plain. Instead of sloping away from the channel the whole space between the foot of the bluffs and the river-bed, minor variations being ignored, slopes towards the channel. The two hill slopes meet in the valley and exclude the flood-plain. The same is true of the great majority of the western rivers. No part of their course corresponds to the accepted definition of the divisions of a river.

The trouble is that the book-definitions apply only to *geologically mature* rivers, while these are *young* rivers, newly formed streams flowing over soft and porous strata. We must first of all recognize the fact that rivers have a life-history; that there are young rivers, grown-up rivers, and rivers that have passed into the dotage of old age. Upon a surface newly won from the sea by continental upheaval, the falling rain flows and cuts sharp ravines and canyons. These are gradually broadened into valleys, but for a long time there is no distinct flood-plain, or rich

bottom land. This feature of rivers, so radically important in an agricultural point of view, only appears when the rivers have gained such degree of maturity that their slope is diminished and deposition of sediment keeps even pace with erosion. In all the valleys of the plains the rivers are so new that erosion is greatly in excess of deposition. The rich alluvium or lake sediment deposited in previous ages is cut up and carried away to the sea. If it remains in the valleys it is so mingled with sterile sands and clays as to be to a large extent obscured and wasted.

Hence it happens that, contrary to the experience of older lands where the richest soils are in the river valleys, the table lands of the plains, which have not yet been breached and robbed of their wealth by new ravines, are, as a rule, better than the valley lands. But wherever the backward-cutting head-water erosion has broken up the rich layer of lake sediment, the smooth table land is soon reduced to a mere remnant. Scattered and broken hills take its place. These are at first too steep for cultivation, but where the breaching of the table land occurred long ages ago the slopes become more gentle and are covered with good soil.

What becomes of the plant-food of which the table lands are robbed by the streams? It runs away to the sea and is lost. Basin irrigation would stop this waste. It is a double waste as the process now goes on. New ravines are constantly breaching the rich table lands and spoiling them, and the waters of the rivers, thus enriched with the best plant-food, are also permitted to run wastefully to the sea without being used either for summer irrigation or basin irrigation.

The *muddiness* of the rivers of the plains is the best thing about them. It means that they are loaded with fertilizing elements. Put that water on the fields till the mud settles and you will convert bottom lands marred by sterile sands or gumbo into garden spots. The best soils on the table lands lie too high for irrigation. In the valleys where water is easily applied to the soil, while it is true that there is no rich flood plain, but many acres of sands, gumbo, and alkali instead, a soil of the highest excellence may be made just where it is wanted, just where it can be most easily irrigated, just where it will be most productive, by the process of basin irrigation.

The two circumstances which in themselves seem highly unfavorable, viz., the poverty of much of the valley land, and the muddiness of the rivers caused by the wasting of the table lands by rapid erosion, may, if properly combined, be turned to the great advantage of agriculture. Another circumstance highly favorable to the practice of basin irrigation is the high gradient of most of the streams, which have a fall of from seven to twenty feet per mile. This will make it easy to construct canals which will carry the water to any point within the valley and lay down a deposit of rich silt upon barren gravel and sand.

Basin irrigation will also be the best remedy for alkali patches. This has been amply demonstrated in Egypt. It stands to reason that repeated flooding followed by thorough drainage would wash out and carry away the soluble alkaline carbonates To ascertain the amount of land which might be redeemed by basin irrigation in Nebraska would require a careful survey of the river valleys. Enough is already known, however, to justify the assertion that thousands of acres in each county, enough to prevent famine in the worst year of drought, may by this method be turned into fruitful fields and gardens.

STANDARD AND COMMERCIAL POULTRY CULTURE.

BY S. L. ROBERTS, TEKAMAH, NEB.

I am aware of the fact that the so-called "chicken business" in any or all of its several branches of culture is looked upon by your average citizen as of minor importance, so minor as to be unworthy of consideration, but by women and children, and not by them if they can find aught else to do.

I am aware that in coming before your honorable body with a paper devoted to this branch of the world's industry I may be deemed to have gone daft, without having far to go, but surely poultry belongs to the farm as certainly as does fruit of tree or honey of hive and bee.

The poultry mania of 1847 had its origin in the importation from the far east into England and America of the Cochin breed. Her majesty, it is true, exhibited so-called Cochins in 1843, but they were so different in form and character from later arrivals as to be unworthy the name. This mania lasted seven years without apparent diminution. As much as 100 guineas was often paid for a single cock. Nearly $500 for a single domestic fowl was considered a round price, to be sure, while for a pen, consisting of five females and one male, it was a common price. All England had the "hen fever," Mr. Wright informs us.

At the same time that England and this country were Cochined there was found in a ship from India in New York city, by one Mr. Knox, another type of fowl altogether different from the Cochin, and were termed Brahmas, or short legged Chittagongs. The Chittagong had been winning laurels under another name for several years, and were known by many as Shanghais. The Knox birds were bred by Chamberlain, Cornish, Smith, and Childs until 1857, when the Shanghais became unfashionable among those early fanciers, and the short legged Brahma Pootra usurped the field.

Not until after the war was begun the systematic breeding of fowls in America from a standpoint or fancy point of view. Mr. Williams, of Massachusetts, had "gone to the front," leaving his birds to be scattered far and near. When he returned he began to buy up as much of his old favorite stock as he could.

From 1866 to 1868 may properly be termed the initiatory years of American fancy fowls. Felch, Comey, Williams of Massachusetts, Todd of Ohio, Foote of Illinois, were early in the field, followed soon by Sanford, Memsfire, Buckman, Smith, Thompson, and others of the east, Burfee, Frink, Bicknell, Pierce, Brobagan, Phenix, and many others farther west.

A national poultry congress was organized in 1871. It died. Then came the American Poultry Association, which exists to-day. Early in the '70's a standard was agreed upon by the association for all domestic fowls of general beauty and utility. This standard has been revised about every five years since its first publication, the last revision being copyrighted as the American standard of perfection.

Poultry exhibitions (including pet stock) are now being held in all the eastern, northern, western, and many of the southern states, ranging from one to to thirteen in each state this year. In England these exhibits are made during every month of the year; in this country they are confined to the months of December, January, and February, but in increasing numbers each year. These annual exhibits give great impetus to the industry, and now at every district, state, and many county fairs in September and October, the poultry exhibits have become so fashionable as to be as attractive as the horse, cattle, swine, or racing departments. To pass upon this department the old committee of three has been superseded by expert judging, using the standard referred to as absolute guide and arbiter, and sometimes using score cards to designate the "point" value of each and every competing specimen. In fact the score card as inaugurated by the poultry fanciers was first in the field. Then other live stock associates began to adopt the card system in judging, which is now quite prevalent everywhere when stock is to be passed upon for prize or badge.

And what has the standard poultry business done that is good for the country and mankind?

It has made profitable and pleasant a much neglected and belittled branch of farm life. It has made possible a source of revenue for cotters and village folk who have not the privilege of actual rural life.

It has dignified the very despised hen and crowned with importance long due him the cock of the walk.

In fact, it has opened a new business from an obscure, neglected, contemptible old one, in which there are now many men whose sole occupation is raising, mating, selling, and judging standard poultry. The American standard of perfection now recognizes six breeds of turkeys, seven of geese, ten of ducks (each breed being a variety of its own), and forty-five breeds of chickens, and seventy-six varieties, making in all ninety-nine varieties. Eleven of these varieties were originated in America and are classed as such, seven are Asiatic, ten are Mediterranean, eight are Polish, seven are Hamburgs or German, three are French, three English, nine are games, and seven are game bantams from various countries, eight are bantams other than game and are from several lands, one is Russian, one Turkish, and one Central American; the foregoing being chickens, or rasores, known by the Latins as scrapers, and technically as gallinaceous birds.

For each specimen there are thirteen sections in the scale, and twenty-two points to consider in the score, with a descriptive standard for each point and section, and different descriptions for each ninety-nine varieties. To become at all expert in judging one must apply himself closely for years in the study and in the show room; and to rear many varieties requires years and years of experience and patience. Then, too, the all-round judge has the pet stock to handle, which is even more difficult than poultry.

In bringing our present stock of domestic fowls to the high standard of breeding attained has cost much time, labor, money, patience, experience, and skill; to bring it still higher is the aim and hope of every true poultry fancier. Nothing but thorough work can produce thoroughbred stock. A family "line" must be first established, pedigrees must be sacredly kept; otherwise the farmer who wants a thoroughbred to cross on his common stock will be unable to find it.

The commercial side of the poultry question is the master incentive to the whole

business. The following figures may seem somewhat watered at first glance. Their correctness is not in question, as they are based upon the probable census of 1890:

This census is calculated by business men to reach over 65,000,000 of people. At the usual five to the family this will give 13,000,000 households. This cannot be far from correct, as there were 9,000,000 families in 1870 and nearly 11,000,000 families in 1880.

Secretary Rusk, in his Report of the Department of Agriculture for 1889, says: "The time has come when the importance of the poultry interests should be recognized in this department. The poultry products of the United States had a farm value of at least $200,000,000 last year, or no less than 16,000,000 dozen eggs were imported at a first cost of over fifteen cents per dozen, or nearly $2,500,000, while the average annual value of such importation during the past four years has been $2,216,326. Such facts emphasize the necessity for encouraging the increase of domestic fowls of all kinds, and they further indicate, beyond question, that this industry is important enough to demand the special consideration of this department. The economics of rearing and feeding, the peculiar adaptation of the breeds to specific uses, merit more official attention than has heretofore been given these subjects."

Statisticians estimate that every family consumes upon the average two dozen of eggs each week of the year, which, at twenty cents per dozen, amounts to $270,400,000. Allow $20 to be consumed in poultry by each family during the year, which gives $260,000,000 more. Total, $530,400,000. A pretty good showing for a "business so small as to be but a pastime for women and children."

The poultry business of France represents an annual business of a trifle over $204,000,000. England buys from her over 800,000,000 eggs annually, and consumes 2,000,000,000 annually herself. The cash value of her importation to England is nearly $15,000,000. She has 98,460 square miles capable of cultivation, labors under climatic disadvantages, is limited in forage, and not under a thorough system of commercial poultry culture, yet makes the business very profitable. Belgium, with an area equal to the state of Georgia, has an annual egg product of 274,967,824. With 11,373 square miles, her population 5,253,821 souls, smallest and most densely populated power in the world, has forty-eight eggs for every man, woman, and child, and from 60 per cent of her area.

The United States imports annually, of late years, from 15,000,000 to 17,000,000 dozen eggs, which, at twenty-four cents per dozen, equals $3,840,000—a brief statement as to how greatly the poultry business is overdone in this country.

New York state consumes and ships about $90,000,000 worth of this food every year, not one-half of which, however, is produced within her borders. Independent of her transient population, New York state and city consumed $45,000,000 worth of poultry and eggs annually, with a home population of 5,082,871 in 1880. By that census this republic had a population of 55,000,000, and must have consumed, by the New York ratio, $495,000,000 worth. Add to this $64,000,000 worth of breeding fowls and layers, and $600,000 for blooded fowls (which amounts are Washington statistics from last census) and the total is $559,600,000 for the annual industry. The statistics for next year's census will raise these figures to over $600,000,000 as the annual worth of the poultry product in this marvelous country.

Men who look upon this important feature of our nation's resources and consider

it "too small a business to trifle with" are reminded of the following statistics, drawn from the United States statistical bureau, and are official, by Mr. J. L. Campbell, of Elizabeth, Pennsylvania, manufacturer of the Eureka incubator. The figures are for the year 1882, and represent the cash value of the respective products of the United States:

Cotton	$410,000,000
Hay	436,000,000
Dairy products	254,000,000
Wheat	488,000,000
Poultry and eggs	560,000,000

Of the latter we export nothing, and are compelled to import. Wheat, it might be said, falls behind poultry and eggs, $72,000,000, or more than four times as much as President Thomas Jefferson paid for the west half of the United States.

Cattle, hogs, and corn—these three alone produced a greater income, each of them, than the poultry industry produced. So small is this industry, suited only to women and children.

Congress and many of the states annually appropriate large sums of money for the planting of lakes and streams with popular kinds of fish, which is progressive and right. But for the propagation and proper cultivation of popular varieties of fowls I have yet to learn that the states have made any extensive appropriations. Bee culture receives some attention at the hands of states and boards of agriculture, I am glad to know, and yet the apiary—bee culture—the honey bee industry, as a source of revenue, is of minor importance to the country at large when compared with the dissemination and collection of new and improved fowls of vitality.

Horticulture, an old, worthy, well nigh indispensable branch of agriculture and source of health and wealth, is assisted by the governments of some of the states in establishing itself and cultivating new varieties. Nebraska makes now a biennial appropriation of about $1,000 for its great industry.

It does a good thing when it so appropriates, too. But great as it is, necessary as it is, it falls far below poultry culture both in greatness and necessity. Who ever heard of a state appropriating much money for poultry culture, unless it be the state of Illinois? It is true that state has in recent years, through its board of agriculture, done something toward a poultry exhibit in connection with its fat stock show at Chicago; that is all. It is better than doing nothing at all.

And your honorable body, the Nebraska State Board of Agriculture, has been liberal in many ways by furthering the interests of the annual poultry exhibit at the State Fair. For this, gentlemen, you have the thanks of every member of the Nebraska State Poultry and Fat Stock Association, I emphatically assure you.

Poultry culture in the west is becoming a great source of revenue. Its culture to Nebraska is worth more to the people than forty immensely large cattle ranches raising thousands of cattle to the ranch. Why? Because the proceeds from the sale of eggs and fowls directly helps more than 100,000 families; the business is in the hands of every farmer and in the hands of fully fifty per cent of the villagers and cotters and suburban dwellers throughout the state. The forty ranches would receive much money, and the proprietors would bank their money. The poultry money goes into circulation at once on a round of paying debts and making purchases for the worker.

Recent figures (made since the last general census) show that each individual in

the state of New York and the city of New York consumes $6 worth of poultry and eggs each year. The figures for Massachusetts and Boston give $10.20 for each man, woman, and child; Ohio, $11.72; Illinois, $8.67; Pennsylvania, $9.85.

Now let the population of Nebraska be estimated at 900,000, and the amount of poultry and eggs consumed be $9.40, and we have the amount of $8,160,000. Now add the value of stock, common and thoroughbred, carried over each year, which at the rate per capita in New York would give Nebraska $13,000, but which we reduce to $10,000, and you have a poultry and egg value in the state of $8,170,000. This is your small "women and children business" that we hear so much about as not being worth the consideration of business men.

Could the broiler branch of poultry be made remunerative in the west as it is in the east?

Yes; near to a city like Omaha, Lincoln, Nebraska City, Hastings, or Beatrice, broilers would be in large demand at all seasons of the year. The larger the city the better the demand, and the larger a broiler establishment should be operated the more thoroughly would the public become educated to buy and eat, as has been the history of the business in the east and everywhere.

Could an egg farm be made to pay?

Near to a large city, yes. Many private families and all hotels and restaurants are willing and anxious to pay an advance over market prices for fresh eggs delivered every other or every morning.

An egg farm may be operated at much less expense per 100 head of stock than a fancy poultry farm. The colonies may be made larger; no males are used, etc.

Standard poultry culture in Nebraska, as in all the western states, is but embryotic. Our state association is striving, under many depressing conditions, to elevate it and make that branch of industry to be recognized as one worthy of candid and careful consideration by our best citizens. It is from the fancy that the commercial poultry side of the question is fed and fostered. It is from the latter that recruits to the former are added. Each helps the other. Either one or both of them afford a source of income not only, but a line of work highly conducsive to health. Dr. T. B. Spaulding of Illinois writes me that he left the practice of medicine weighing 135 pounds, and the victim of dyspepsia, and entered the ranks of fancy poultry culturists, where he remained an active member (which the fancy world in America can vouch for) for nine years. At the end of the nine years he had recovered his health and weighed 177 pounds.

The standard side of the business has its votaries among lawyers, judges, doctors, professors of colleges, ministers of the gospel, wholesale merchants, salesmen, and bloated bondholders, as well as other business and professions. It is often termed "Fancy," which is a misnomer; it means thoroughly bred poultry more than fancy.

The day comes when the thoroughbred breeder as well as the dealer in common fouls will be recognized as a dispenser of wealth of the state.

Strike from the face of this country all the domestic fowls and eggs for a period of six months and imagine, if you can, the condition of things at hotels, in kitchens and elsewhere. Six hundred million dollars of property to the country means something; $8,000,000 to Nebraska talks a language we can all interpret.

PROFITS AND PLEASURE OF SILK CULTURE.

BY JAMES PEARSON.

In the first place we may state the fact that the profits and pleasure of silk culture depend, to a great extent, upon the person engaged in it.

It is not to be understood that silk culture is an exceedingly profitable business, but we encourage the silk industry for the following simple reasons: It adds much wealth to the nation engaged in it, as well as it employs much labor that is quite unfit for the heavier duties of life. It is a well known fact that there are many unemployed persons who cannot procure employment during the summer, or who are quite unfit for heavy work. If all such would engage in the silk industry enough silk could be produced to supply the United States silk market.

It seems that there are a great many people who do not understand the true nature of silk culture, and thus many wild and false reports are advanced. The exact and true knowledge of silk culture cannot be procured from books or papers, but can only be had by actual observation. In order to give a general knowledge of the character and life of the silk-producing larva, I will give a brief statement of my actual observations of the past summer.

About the middle of May I received a small quantity of silk worm eggs from the United States department of agriculture. On May 23 the first worms made their appearançe (being only one-eighth of an inch long). I at once placed them upon shelves and began to feed them upon the common Osage hedge leaves. I found that the life of the worms were divided into five stages. The first stage being adout five days long, and each succeeding being one day longer than the one previous. The stages were separated from each other by the moulting periods, which last from a half to three-fourths of a day. On June 29 the first worms reached the spinning point, or became full grown, being three inches long and of a rich cream color. When the spinning point was reached they quit eating, became restless, and crawling about until a suitable place was found, they began to spin their silk cocoon. It took each worm about three days to complete his cocoon. When the cocoon is completed it resembles a peanut in shape and color, taking about 400 to make a pound. The worms weave themselves inside the cocoon, and in order to save the silk, the cocoons are steamed to kill the chrysalis.

Thus, from the above dates, it may be seen that the life or time occupied in the silk industry does not exceed six weeks.

In the first place no one should attempt to rear silk worms unless he has plenty of Osage or mulberry leaves at his refusal, as these are the only American grown leaves upon which the silk worms can be successfully reared.

It must be understood that a person can make but little or no money the first year. But the amount of knowledge obtained from the silk industry the first

year is considered quite well worth the time and work involved. Our experienced silk culturists give us a few figures, which will give us a good idea as to what profits are involved in the silk industry for those who will be faithful to their posts. Two persons can work together to a better advantage than they can separately. Two persons can care for the worms from three ounces of eggs (more than 100,000). These worms, after being cared for for thirty-five days, will spin about 300 pounds of raw silk; this silk when stifled will be 192 pounds, and then it will sell for a dollar or more a pound. Thus the two persons will receive one hundred and ninety-two dollars. Allowing twelve dollars for expenses, we will have left eighty dollars each for the two persons. One good thing is, that boys and girls of medium age can do nearly as well as grown persons, as about all the work is to pick the leaves. One worm will eat a half pound of leaves during his life. Give the boys and girls a chance. Remember that—

> "If at first you don't succeed,
> Try, try again."

We have an excellent climate and abundance of food, and surely we have an abundance of unemployed labor to produce enough silk for the whole of the United States. Then I leave the question with the people of this great state: Shall we continue to import our great amount of silk, leaving so much silk-producing food go to waste, or shall we take hold, use our unemployed labor, and not be so wasteful, and thus grow our own silk?

PREVENTIVE INOCULATION.*

BY FRANK S. BILLINGS, DIRECTOR OF THE PATHO-BIOLOGICAL LABORATORY OF THE STATE UNIVERSITY OF NEBRASKA.

Preventive inoculation is an unquestionable possibility in all diseases of a non-recurrent character. Nature has indicated this fact for hundreds of years, but man has scarcely learned to appreciate it. We start upon an already open path. At its very entrance we can see the guide-post "non-recurrent." To pass on to success requires simply honest and heroic workers. The spirit of a common humanity should rule where greed for the almighty dollar now reigns supreme. The nation itself must be educated to an appreciation of what can be done; then success will come. Only heroes can do such work. The present reign of mediocrity and unprincipled selfishness in our laboratories must be crushed. Better anarchy than the existing conditions! Fraud rules in the place of scientific honesty. Salary grabbers occupy places which should be filled by original investigators with the true scientific spirit. No mind but a free one can investigate correctly.

THE DIFFERENCE BETWEEN EXPERIMENTAL AND PREVENTIVE INOCULATION.—These two procedures must be most sharply differentiated. While preventive inoculation must necessarily depend upon experimental for its perfection, we have no need to resort to it to demonstrate prophylaxis by this method to be a possible fact. Preventive inoculation does not depend upon experimental for its demonstration as a possibility. Nature has already done that as mentioned.

THE TRUE VALUE OF EXPERIMENTAL INOCULATION.—What do we mean by experimental inoculation? Let us thoroughly understand that first.

By experimental inoculation we simply mean the transference of the disease products (or pure cultivations of the micro-organismal cause of a given disease) from diseased to healthy individuals of the same, or other species of animal life, in order to see what the results may be.

It is an attempt at transference, nothing more.

The success of such an experiment is determined entirely by the nutrition offered, by the animals inoculated, to the germs of the disease inoculated.

The amount of imbecile nonsense which has crept into medical literature upon this subject is almost indescribable. Koch and his school are almost entirely to blame for it. It shows an utter want of true pathological knowledge and philosophical acumen. It is entirely wanting in sequential logic.

It has been assumed that experimental inoculation in small animals must of necessity determine the real nature of the disease of the animal from which they were inoculated. Such an hypothesis is absolutely absurd. It need not necessarily determine anything of the kind.

* Read before the Section for State Medicine at the Annual Meeting of the American Medical Association, Nashville, Tenn., May 22, 1890; and the Chicago Medical Society, June 2, 1890.

These writers do not know the logical definition of the word *contagious*. While they frequently write deftly about "faculative" and "obligatory parasites," their language in regard to the results of experimental inoculation shows that they use words without knowing their logical application. They speak of the "contagion of anthrax" (a faculative parasitic disease), and the "contagion of glanders" (an obligatory parasitic disease), in the same breath. Logically speaking, the word "contagious" simply means the coming in contact with an infectious principle, utterly regardless of its origin. It may be a syphilitic person in one case and a filth hole in the ground in another. Both may be equally "contagious," but the inficiens in each case had a different origin. This, and this alone, must decide the nature of a disease. They must, of necessity, be either ex- or endogenous primarily. Practically, all physicians and hygienists know what they mean by a "contagious" disease. They mean that a diseased individual must be, or has been, present of a given species of animal life as its primary source of origin. Historically, we know of no other primary genesis for these diseases. We know that no individual can acquire syphilis, or glanders, or scarlet, or mumps unless an individual having been afflicted with one of these diseases has been in the immediate vicinity. The closeness of the contact necessarily varies in different diseases. Remove such diseased individuals, clean up or destroy their belongings, and the danger of contagion is removed.

Experimental inoculation cannot strengthen the case in the least degree. The endogenous character of such diseases, that they were strictly contagious in the practical sense, was known centuries before a bacterium was ever heard of. Only bacterio-fanatics seem to be ignorant of this fact. Inoculation of small animals cannot strengthen it an iota. To ignorant minds it might weaken the practical every day evidence. All animals are not equally susceptible to a given inficiens. Even though experimentally inoculable, a given contagious disease often loses its specific, practical characteristic by inoculation in experimental animals of a given species, but different from that in which it naturally occurs. For instance: glanders, transmitted from a diseased horse to rabbits or guinea-pigs, will not extend, of itself, to uninoculated rabbits or guinea-pigs. It is not contagious in these animals.

A recent writer says that the "crucial test" of the contagiousness of tuberculosis was only obtained when the results of inoculation in rabbits and guinea-pigs had become known. Nonsense! The "crucial test" is the result of contact between diseased and healthy individuals of the species in which a disease naturally occurs, or is naturally transmitted to by accident. According to these absurdly illogical observers of pathological phenomena, syphilis should not be contagious because non-transmissable by inoculation to domestic animals. Why any sane person, looking upon himself as an investigator, especially such an one as Koch, should speak of the contagion of anthrax, swine, plague, diphtheritis, or rabbit septicæmia, passes one's comprehension. The latter disease has been especially mentioned, because it is not a natural disease in rabbits, simply to demonstrate the utter absurdity of this position.

The word "contagious" does not properly express the practical and hygienic meaning attached to the diseases to which that name has been given. As repeatedly stated, and as must be definitely understood, it simply means contact with an inficiens, and has no absolutely necessary connection with origin. Let us il-

lustrate this with an example: A physician makes an autopsy on two different persons on the same day; the one has perished from syphilis, the other from anthrax. In both cases he accidentally cuts a different finger, and in one becomes a chancre, in the other a malignant pustule develops. Such a thing is possible, but not probable. What has taken place?

Accidental inoculation, through contact with two differently-diseased individuals —contagion. The primary origin of these two diseases has been entirely different, however. The syphilis primarily originated from another individual; the anthrax from the ground of some locality. The one is endogenous, the other exogenous. This at once demonstrates the folly of any further use of the word "contagious" in the differential classification of diseases, as it does not express our true meaning.

To sum up, then, we can logically speak of diseases as extra-organismal, or exogenous; intra-organismal, or endogenous, and sporadic—that is, of undemonstrable origin; or, in other words, from the etiological point of view we can logically only classify diseases according to the primary origin of their cause. Or, to speak with Hueppe, as "obligatory parasites," by which he means that such etiological moments are primarily bound on the conditions offered by some form of animal life for their existence and continuous development; or, in other words, such diseases are "endogenous" in origin, to speak with Pettenkofer, or intra-organismal in origin, as I have termed it.

An endogenous disease is one which, so far as we can historically trace its genesis, has found, and still finds, its locus of primary origin for each new outbreak or extension of the disease in a diseased individual of some given species of animal life (and never in any other way), and then passes directly from the diseased individual to another susceptible, healthy one, either by direct contact or cohabitation, or by contact with some effluvia, secretion, or other material which has either come directly from, or been in immediate contact or relation with, such a diseased individual.

Speaking in the old sense, such a disease would be "contagious." Speaking according to the nonsensical usage of the word at present, no one can tell what its true origin might have been.

In contradistinction to obligatory parasitic diseases, Hueppe has given us the term "faculative parasites," by which he means to indicate diseases of parasitic origin, in which the point of primary development of the germs is invariably outside the animal organism; but they have the faculty of living for a time within the organism of certain species of animal life, becoming parasitic or disease-producing for the time, when such animal organisms offer the necessary nutrient conditions to their life. To this class Pettenkofer has given the name "exogenous," while I have termed them "extra-organismal," or diseases which find their primary origin in external or surrounding conditions. Or, in other words:

An exogenous disease is one which invariably finds its locus of primary origin not in, but outside of, an animal organism; that is, in the earth, or in the surroundings of animal life, where its micro-organismal cause develops under certain conditions of climate and soil, which offer the necessary nutrient conditions to the life and continuous development of its germ.

The infected earth or locality bears thesame relation to animal life in the origin of exogenous diseases that the infected animal organism does to healthy sus-

ceptible animals in endogenous diseases; that is, they each form centers of primary origin regarding specific diseases in their respective class, but with this difference: *the focus of primary generation, or infection, is fixed in exogenous diseases, while it is movable in endogenous.*

The *locus infectionis*, that is, the point of primary infection or origin, is contagious in either case. In the one, a healthy susceptible individual must come in direct contact—that is, be upon, or in, such an infected locality, or come in contact with material derived directly from such a locality; while in an endogenous disease the same occurrences must take place in reference to some form of animal life. Hence it is to be readily seen that the word "contagious" has no logical use or place in the nosology of diseases, according to the results of modern methods of investigation.

PREVENTIVE INOCULATION.—Preventive inoculation is an entire different procedure. It is based upon a natural phenomena, viz., that a given disease is non-recurrent in character. But more; that this non-recurrent condition of the organism is produced equally as well in the mildest attack of a given disease as in cases in which the diseased individual barely escapes with life. Diseases of this non-recurrent character are small-pox, typhus-abdominalis (vulgarly called typhoid fever), measles, mumps, scarlet, whooping-cough, chicken-pox, yellow fever, and some others in the human family; and in the domestic animals some of the so-called horse distempers, contagious pleuro-pneumonia in cattle; anthrax, swine-plague, rouget in swine; hen cholera; Southern cattle-plague (Texas fever), and black-leg, and probably the corn-fodder disease, and others.

Some authorities assert that Asiatic cholera is also non-recurrent in character, and I am inclined to think that glanders can be made so by the inoculation of farcy in a mild form. There are probably quite a number of these diseases still unknown to us in the poorly-investigated portions of the globe. I am one of those who, at present, does not believe that rabies is a non-recurrent disease, and hence have no faith in inoculation as a preventive. That non-recurrent diseases can be prevented by inoculation was first discovered in small-pox, and then demonstrated by Pasteur to be possible in anthrax, hen cholera, and rouget, and by Arloing and others in black-leg; by Willems in pleuro-pneumonia in cattle; by Freire in yellow fever in Brazil; by the author in swine-plague, and by Dr. Paquin, of Missouri, in Texas fever in this country. With none of these diseases but small-pox can we claim to have arrived at any perfected method; but still, the immense losses incurred, and the practical results which have followed, warrant the continuation of present methods until others are discovered, or these improved upon. The value of their discovery, and the practical demonstration that inoculation will prevent in the diseases enumerated, cannot be overestimated. It shows what can be done, and will be a stimulus to more extended endeavors. It is my firm belief that before the end of the next century every non-concurrent disease at present known to us will have been brought under the control of preventive inoculation, but more especially those of child-life.

Who can place a monetary value upon such results? Is not the mere possibility of such a result promised, as it is directly, to us by the very non-recurring nature of these plagues of our babes, sufficient to warrant the establishment and maintenance of laboratories for such investigations by our national and states governments? Is it not the duty and mission of a board and wise statesmanship to meet

this great want? Is not a vigorous and healthy condition of our people the very kernel of a prosperous political economy? Then why are we sleeping? Why is the medical profession so dead to its duty? Is it that a prosperous grave-yard makes plump pocket-books? No! no! It is ignorance and thoughtlessness; but, most of all, a lack of the true, humane, and noble spirit which should dignify the medical profession of a country.

A perfected condition of the human race should be the only ideal to be sought after by the medical profession. Exact and scientific government schools can alone produce this desired condition. Speculative institutions, or any such as depend either in part or in toto upon a students' fees for support, can never give anything of value to the country. They may turn out a few competent physicians, but never scientifically qualified ones.

With this introduction, let us turn to the consideration of preventive inoculation once more, especially to its introduction in relation to small-pox. We have said that inoculation was the transmission of the products, or cause, of disease from a diseased to a healthy individual. In relation to the prevention of small-pox, this procedure is known as *variolation.*

To repeat: variolation was, or is, the transmission of small-pox itself from diseased persons to healthy ones, by the inoculation of the products of disease themselves. This procedure was first practiced by the Chinese and East Indians, a long time before the birth of Christ; but was not inaugurated into Europe until many centuries lates. Small-pox itself is produced. Why, then, was it resorted to? Any one at all acquainted with the epidemiological history of diseases before this century, especially in the fifteenth, sixteenth, seventeenth, and eighteenth centuries, must know what terrible misery and desolation this plague caused. Many districts, and even cities and towns of considerable extent, were almost depopulated by it.

We of to-day can scarcely form an idea of the ravages of small-pox in Europe in the past centuries; but the quotations of a few figures will at once enlighten us, and when they are compared with the same results of to-day, the benefits of vaccination become at once apparent.

Between 1866 and 1869, 140,000 people died of small-pox in the departments at Bombay and Calcutta; and in all India, in 1874–5, the deaths from this cause were estimated at 500,000; and 200,000 in 1875–6. Between the years 1711 and 1740, 65,000 people are reported to have died from small-pox in England. In 1734, two-thirds of the population of Greenland died—7,000. The deaths from this disease equaled the births at Turin, Italy, from 1796 to 1797. In Prague, Germany, the deaths were 6,686 in 1796, and 15,558 in 1799. In Prussia, 1726, 24,646. In the province of Wurtemburg, in 1790–1800, 36,933. France, from 1725 to 1754, 760,000, of which Condamine says* that this number of lives could have been largely saved had there been a general recourse to variolation. In Sweden, from 1749 to 1765, 144,194 deaths from small-pox were reported. In London, in sixty-seven years the deaths from this cause were 113,851; and from 1837 to 1840, 36,000.

Why was variolation resorted to? There must have been some one striking phenomenon in the clinical history of the disease which attracted even the general attention of the common people. What was it? It was the fact that the disease, in general, was "non-recurrent" in character. Outbreaks at that period of the

* Memoire sur l'inoculation de la petite-veriole, 1854.

world's history occurred almost constantly, though in some years, or at intervals, to a far more murderous degree than at others. This condition of things soon demonstrated to the people that, as a rule, those who had the disease once seldom suffered a second attack. They had abundant opportunities to test this fact. They also discovered a second fact, which was of far greater importance. They noticed that in years when the disease only appeared here and there among the people, and not as a general epidemic, that it was unusually mild in character; and also, that those catching (contagion) the disease from others generally had the small-pox in the same mild manner. In other words, as in other things in nature, they saw that "like (generally) begat like," or that a mild, a non-malignant type of small-pox in one individual generally produced the same character in another, if exposed to infection from the first. As has been intimated, the Chinese and other Asiatic people observed this valuable fact centuries before it received any recognition in Europe. They were then well acquainted with several facts in the history of small-pox, which were:

1. That when malignant in its first appearance, it would preserve that character among the whole population.
2. That when mild it held the same course.
3. That it was non-recurrent, as a rule.

This last was a tremendous discovery. These so-called barbarians seem to have been practical enough to endeavor to take advantage of these phenomena. Knowing the difference in the results between a malignant and mild outbreak, and that the disease did not generally recur again in the same individual, and that at no time could those that had not been diseased be safe from its ravages, they took advantage of the mild outbreaks and tried to induce the disease, at such times, in every susceptible member of the community.

The first attempts at transference were those most natural to occur to the untutored mind—non-diseased persons were obliged (or did it themselves) to wrap the clothing of diseased ones about them, or the scabs were rubbed on the skin, or upon scarified or wounded places. In India, where the history of variolation seems to extend into the misty and indefinite past, it was entirely in the hands of the Brahmin priests, and hence acquired a very wide extension. They had certain seasons of the year in which they went among the people for this purpose, who were especially prepared for it, by certain known dietetic regulations. The priest then went from hut to hut variolating the people at the door. The point of attack was the outside of the fore or upper arm. The skin was washed thoroughly and then rubbed hard with a dry cloth at the point selected, small incisions being made in it. The virus inoculated with was from the previous year and dried on cotton, which had been saturated from diseased individuals. They never used fresh material. Variolated people were subject to especial hygienic rules for a period of four weeks.

It is said that the danger from this treatment was so small that it was rare that any one died therefrom. It seldom failed to give protection. In Circassia it was resorted to in the early life of the maidens, in order to preserve them from the scars of the natural disease which would render them unsuitable for sale to the lords of the harem.

From Asia, Arabia, and northern Africa this procedure finally extended to Europe by the way of Turkey and Greece, but found the most bitter opposition

from the physicians of the time, and the clergy, the chief objection raised being that it was trifling with the will of God to take measures to prevent anything which He caused; that small-pox was a punishment of the Lord's for the sins of humanity, and hence justly deserved. (See DeHaen and other writers of the period; Haeser, "History of Medicine; Bohn, "Handbuch de Vaccination," and other works upon small-pox.

Early in the seventeenth century, however, variolation became a "boom" (if I may be allowed a modern expression) in England, which was instigated by a courageous woman, Lady Montague, the wife of the British ambassador at Constantinople, where she had seen the procedure and learned of its real benefits. On her return to London, in 1717, she had her six-year old son variolated, and four years later her only daughter. This venturesome act set all fashionable London in a whirl of excitement, and by order of the king six persons that had been condemned to die were pardoned on condition that they would subject themselves to inoculation, and then be exposed to small-pox. This was done with the most positive and satisfactory results. Soon afterwards, the children of George I were inoculated, and then the treatment became more or less fashionable.

It is only justice to the fair sex to mention that to a woman also, the Marchioness Buffalini, is due the generalization of variolation in Italy.

Variolation had two historical periods. The one beginning, as has been shown, in the earliest days of historical record and extending to the year 1760. This may be called the Crude Empirical period.

The second, which may be called the period of Exact Scientific Observation, began and continued to the demonstration of vaccination by Jenner, May 14, 1796.

If vaccination had its Jenner, so had variolation its Gatti, to whom the world is equally indebted, for it was almost entirely due to the acute observational powers and logical conclusions of this great Italian physician, that variolation itself became an almost safe and equally valuable prophylactic measure to vaccination. Though there seems to have been no historical connection between the work of Gatti and Jenner, still the one did prepare the way for the other, for Gatti demonstrated most conclusively the almost safe prophylactic power of variolation (to the individual inoculated), and hence his work gave a substantial and practical foundation to vaccination.

Variolation was the first great and successful experiment in the history of pathology, as well as the very foundation of preventive inoculation. It was the first practical demonstration of the fact that non-recurrent diseases could be actually prevented by artificial inoculation; that the art of man could successfully reproduce the work of nature; that, as in nature, a mild attack of the non-recurrent disease occurred, so could man, by the transmission of the disease product, from such a person to a healthy individual, also produce the same mild disease; and, hence, induce in the inoculated individual that same immune condition which nature produced, under similar circumstances.

The name of the real European founder of such a beneficent procedure should not have been allowed to have been so profoundly buried in the archives of medical history. How many American physicians ever heard of the name of Gatti, and yet it should be kept as fresh in memory and crowned as plentifully with laurels of gratitude as that of the ever immortal Jenner.

Regarding Gatti's relation to variolation, I will take the liberty of quoting directly from Bohn, who says: "No one penetrated more profoundly into the essentials of variolation than Gatti, and no other succeeded as well as he. Gatti is a wonderful phenomenon in the history of medicine in the past century. Nearly every page of his little book on variolation astonishes one by its richness in ideas and its advance over those ruling in medicine at the time. He was a thoroughly unprejudiced and positive observer, sharp and logical in conclusions, with a clever understanding of the nature of pathological experimentation, and knew how to give the correct answer to questions coming before him. One can have but a very superficial idea of variolation in the previous century who has not studied Gatti's work, which is characterized by its clear method, modesty, and great humanity."

Gatti's instructions as to the treatment of persons to be inoculated carry us back to our youthful days, when we had to be prepared for vaccination with cooling salts and other restrictive dietetic measures. He says: "All physicians have said that the persons to be inoculated must be first prepared; second, such inoculation-traumata must be made as to allow for a free outflow of the inoculated material; third, as soon as the eruption appears, the patient must be treated with all the care and assistance possible to the physician. On the contrary I say: patients need no preparation; the physician should never provide for the outflow of the inoculated material by such wounds; and the inoculated person should be left to nature." "To prepare an individual for inoculation is the same as endeavoring to give him a certain predisposition which one considers necessary in order that the inoculated disease shall do him the least possible harm. Is there such a disposition, or can such be produced? We do not know it and hence cannot produce it. Health itself is the best condition, and this alone has one to consider in variolation. An unhealthy person must be first made well before he can be inoculated, but those who are healthy are already prepared for it. Every special preparation on the part of the physician is, however, dangerous. Only those things must be avoided which are liable to interfere with the health. All conceptions as to the preparation of the individual, all endeavors to purify or refresh the blood, or to prevent the inclination of the blood to inflammation, no soul in the world understands and all endeavors in these directions can only lead to the injury of the individual."

Of inoculation he says: "The material with which we will inoculate must be introduced into the vascular layer of the dermis. The variola virus is so intensive that the most infinitesimal amount is as serviceable as a great mass. It is sufficient, therefore, to simply scratch the epidermis with a needle moistened with the virus, or push it gently for a short distance under the same. This way was first introduced by the inoculators, mostly women, in Greece and Italy, and gave most satisfactory results. Only the physicians have sought to replace this simple and efficacious method by more artificial ones and complicated apparatus."

The barbarism of the physicians of the time cannot be overestimated. Extensive incisions were made in the flesh and the cavity filled with thread saturated in the secretion of diseased persons, or even pieces of their filthy clothing placed therein and held in place by bandages. In other cases, a whole skein of thread would be soaked in such secretions and drawn through the flesh, as a seton. The terrible results and unfortunate complication of such methods can well be appreciated at present, and the value of Gatti to the world better understood now than

ever. His motto was, "Inoculate cleanly and delicately, and all after treatment is unnecessary." It is a matter of question if that advice is not as applicable to-day as when he wrote, even with our improved methods of obtaining virus. I have seen physicians vaccinating the poorer class of school children use the same lancet to scarify the arm on one after the other, with no attention given to washing the arm, that in many cases were dirty enough. To my mind such a procedure is criminal carelessness, and does much to bring vaccination into evil repute and furnish just and apparently reasonable objections to its opponents. It suffices to say that Gatti's success as a variolator was phenomenal, and that his reputation extended all over Europe. So great did his skill in diagnosis become that he could almost invariably select the correct type of the disease from which to produce the same mild form in persons inoculated. Very few pustules followed his treatment, and only slight constitutional disturbances in most cases. In fact it is due to Gatti alone that variolation became a reasonably safe procedure between the year 1760 and the introduction of vaccination by Jenner.

OBJECTIONS TO VARIOLATION.—Variolation was not only resorted to as a strictly prophylactic measure, but also that the march of the disease might be hastened, and every one in a community, not previously diseased, might have it at the same time. Variolated persons were, however, as dangerous to healthy ones as those acquiring the disease in the natural manner. They had the small-pox, and hence could be the means of extending it. Therefore, while most extensively practiced, and in many cases made obligatory by law, on the outbreak of small-pox in a locality, still such places was treated as pest-centers, and all communication between them and the surrounding world was shut off until the disease was declared at an end, and the locality cleansed and disinfected, as best they knew how.

The cleverness of these early variolators cannot be overestimated. They insisted that persons to be inoculated be kept by themselves, or from general intercourse with the people for twelve to fourteen days previous to the operation, in order to avoid, as far as possible, the danger of natural infection. They discovered that early childhood was the best time to inoculate, and also that the virus mitigated somewhat in virulence when transmitted from individual to individual. They also paid strict attention to using the clear lymph before the eruption became pustulous, and even collected it in fine glass tubes for conservation. The crusts were also pulverized and so preserved. They found that certain persons were immune towards variolation, about five in one hundred, which singularly corresponded with the percentage of immunity noticed in natural outbreaks of small-pox. It is easily to be seen that, at the best, variolation was a somewhat dangerous procedure; not only could it extend the disease, but fatality sometimes followed it, percentage being about one to one hundred. Nevertheless, it was a vast advance in prophylaxis, as can readily be seen by comparison with the death rate from the natural disease. Then again, it was found very difficult to exert a proper control over all the inoculated persons, as they were frequently scattered through the community, thus making centers of danger wherever they might be. Notwithstanding all this, there is no doubt but what it proved a great blessing to humanity, and was the means of saving thousands of lives and much misery.

While variolation was forbidden on the continent of Europe soon after the discovery of vaccination, it was continued in England until the year 1840, and prac-

ticed fully as much as vaccination, when it was also forbidden. It is still practiced, however, among many of the people of Asia and Africa.

JENNERISM.—The word "vaccination" is derived from the Latin word "vaccina," of or from a cow, and expresses the transference of the disease known as the cow-pox, "vaccina," from cows to man. There has been much discussion in the past as to the true nature and origin of cow-pox, without any uniformity of opinion having been arrived at. To my mind it seems as if the observers were almost entirely without ordinary powers of reflection and the ability to draw sequential conclusions. Variola, or small-pox, has been given different names, according to the species of animals affected, as *V. bovina*, *equina*, *ovina*, and *humana*. The fact that the inoculation of an animal of a given species from one of another species afflicted with the variola common to it generally protect the first from either natural infection or the inoculation of the disease common to its species seem never to have been properly appreciated. To my mind it indicates a common origin, and that there is but one variola.

The two malignant forms are those seen in man and sheep, while in cattle and horses the disease has a benign character. Sheep have been protected against variola by vaccination from cattle, and cattle and human beings by ovination from sheep. In fact, ovination of human beings was once looked upon as fully equivalent, in preventive value, to vaccination.

As has been said, these facts of general prophylactic relations between the various variolas surely indicate but one original form. Whether that point can ever be distinctly decided may be doubtful, but there is no doubt whatever but what we can at once deny all idiopathic attributes to variola in cattle and horses, and emphatically assert that as diseases *sui generis* they should have no recognition. In fact, in both cattle and horses variola fails its one essential characteristic. It is not contagious. Transmission by means of the milkers does not constitute contagion!

The transference, inoculation, of either human or ovine variola to cattle through a continued series of these animals, soon mitigates the virulence, so that when again inoculated upon the original species the contagious factor has been lost. But this is another most valuable pointer in the direction of the original variola. In the days of variolation the most celebrated observers all agreed that the virus of small-pox itself became mitigated on being transferred from man to man through a large number of generations or individuals. No such phenomenon as this has ever been observed in sheep-pox. It does not lose its virulence in being passed from sheep to sheep. On the contrary, sheep-pox becomes mitigated by transference in all the animals it has been attempted on, man, cattle, rabbits, goats, and horses, but the contrary experiments have never been essayed. Vaccina has never been carried through sheep for a long series of generations, nor has small-pox nor the eruption in horses. All this demonstrates one fact, that if every other kind of variola loses in virulence, even by transmission in its own species (using the accepted idea of specific variola), except that of sheep, then the ovine organism provides the most suitable nutrition for the preservation of virulence alone—contagiosity, the human next, while in cattle and equines it is soon lost altogether.

As a matter of experiment, and great pathological interest, it is important to endeavor to build up vaccina to contagiosity again in sheep, if it can be done. It is singular that observers should have looked upon the bovine and equine compli-

cations as idiopathic, when in the former it is limited almost entirely to cows, and in both is not a natural contagious disease, only extending by accidental transmission.

It is a matter of absolute certainty that vaccina either owes its origin to the human or ovine disease, most probably the former; and that it was transmitted to cows in past ages in some way by milkers, who also took care of their friends diseased with small-pox, and then the eruption was transmitted in the same way, by the milkers, from cow to cow in a herd, and in this way the disease acquired a constant degree of mitigation—in fact, absolutely lost its virulence, or contagiousness, but still retained the prophylactic principle. Right here let me make a statement which seems to have escaped notice, or expression, at least, and which is of the utmost importance in the study of preventive inoculation: What does this peculiar deportment of vaccina teach?

The very fact that the virulence, contagiousness, of small-pox having been lost in the change from variola to vaccina, shows us that the germs of non-recurrent diseases have the ability to produce two different chemical materials—one pathogenic, the other prophylactic, and that tests of virulence have no value or control in the question of prevention.

Later on we will return to this question in detail.

It seems never to have been properly appreciated, that there is not on record one single eruption of variola in cattle or horses of a general or epizootic character. As a herd disease, under natural or free conditions, we have no record of it. This again tends to support the hypothesis that the disease in these two species found and finds its origin in the small-pox of man, rather than in the variola of sheep.

Again, as strong proof as can be brought to bear in favor of both these suppositions, and of vaccination itself is given by the fact that with the generalization or compulsion of vaccination, not only has small-pox been brought under most wonderful control, but cow-pox has been almost entirely lost sight of. While there have been cases of small-pox every now and again, and sometimes quite a number in a locality, no one ever hears of a case of cow-pox, and seldom of anything causing a suspicion of the same.

Bohn says, that while vaccination had its Jenner, it was never fortunate enough to have its Gatti, as did variolation. When I read that passage I could not but think that the worthy German had spoken in ignorance, and that vaccination had indeed had one to take part in its development; one the equal of the great Italian in every respect; one whom we should all delight to honor and to whom this country owes a monument of gratitude, if humanity does to any man, in its development on American soil. I allude to the late Dr. Henry A. Martin, of Boston, the introducer of animal vaccination into this country, a man with more sterling manhood, a more honest brain, and the most comprehensive scholar it has been my fortune to meet among the physicians of his country. In fact, I will go farther, and say, that from the standpoint of a fearless man and a devoted and true physician, Henry A. Martin was the only whole man I have ever met in the American medical profession. He was no trimmer; no politician; in fact, he was without policy, as every man should be where truth is concerned. Most physicians in this country are trimmers. They "trim" their professional sails to suit the theological or political breeze, or social conditions. Men are so scarce! Dr. Martin spent a great deal of money trying to find a genuine case of genuine cow-pox in this

country, and during his many years of earnest study found but just one. I visited some cases of eruptions in the teats of cows with him, and have been called to many others since, but in none of them has the trouble had any close resemblance to vaccina.

It is the general opinion that Jenner discovered vaccination, and it is for that that he has been honored and credited. Jenner's discovery was the humanization of vaccina; animal vaccination, true vaccination, is of a much later origin, and owes more to Martin for its generalization than to any one else, but it is not the exclusive right of any one man. Jenner's method was to take vaccina from accidentally inoculated human beings, and then to pass it indefinitely from person to person. Probably the very crusts, or scabs, used on us in our youth were direct derivatives of those first originated by Jenner.

That cows had an eruption on their teats which could be conveyed to human beings, and which did prevent small-pox in such individuals, was known long before Jenner's time, seems to be a matter beyond all question. Even that vaccination itself was practiced in England by one Benjamin Jesty, on his own wife and child, in 1774, twenty-two years before Jenner inoculated, is equally true. That vaccina in some way was transmitted to dairy people, and prevented small-pox, was also known to the common people in Germany and other parts of Europe, but no practical use was made of the knowledge. It remained for Jenner to do this. Jenner supplied the exact and trustworthy foundation to a matter of popular belief among a certain class of people, but of which the majority had no knowledge. Jenner's work was thoroughly original. There is not a particle of evidence going to show that he knew anything about the vaccination of human beings by a few others before he attempted it. Not one of those men gave any exact study to the subject, while it is said that Jenner studied, and observed, and weighed all the facts for thirty years, before he attempted to prove his observations and fortify his conclusions by direct experiment on man. This was done on a boy named Phipps the 14th of May, 1796. But this boy was not vaccinated from a cow, but from one Sara Nilmes, who had been accidently inoculated from a cow, being a dairy-maid. The boy resisted all attempts to transfer small-pox to him by variolation.

It is doubtful if Jenner ever resorted to vaccina itself, that is, to a diseased cow, for his original material, but invariably took his stock from human beings. This should be called Jennerism, or Jennerization.

The one striking peculiarity of this and vaccination, in contradistinction to variolation, is, that the inoculated individual is not contagious to his own species. This is a very striking example of the true meaning of the word "contagion," which, as has been discussed elsewhere, seems to be entirely beyond the comprehension of the medical profession and investigators, with but very few exceptions.

Sycophantic worshipers of Robert Koch, and even the Master himself, are respectfully referred to this example, and asked to ponder a moment that they may learn that contagion and inoculability have no necessary relation, that contagion really means, that the point or locus of the primary organ of the inficiens is a diseased individual.

As has been stated, the very strongest examples of the value of vaccination are not only the very few outbreaks of small-pox which now occur, but also the almost total disappearance of cow-pox among the cattle of those people where any exact control of the question can be looked for. Statistics, as to the value of inoculation, can have but little additional importance, still, a few are appended.

*Table Showing the Effects of Vaccination.**

Period of Observation. Before vaccination.	Period of Observation. After vaccination.	Place of Observation.	Average annual death-rate from variola to the million population. Before vaccination.	Average annual death-rate from variola to the million population. After vaccination.
1777-1806	1807-1850	Lower Austria	2,484	340
1777-1806	1807-1850	Upper Austria and Salzburg	1,421	501
1777-1806	1807-1850	Steyermark	1,052	446
1777-1806	1807-1850	Illyria	518	244
1777-1806	1838-1850	Triest	14,046	182
1777-1806	1807-1850	Tryat	911	170
1777-1806	1807-1850	Bohemia	2,174	215
1777-1806	1807-1850	Austria-Silesia	5,812	198
1777-1806	1807-1850	Galicia	1,194	676
1777-1806	1807-1850	Bukovina	3,527	516
1777-1806	1810-1850	Province of East Prussia	3,321	556
1776-1780	1816-1850	Poland	1,911	743
1776-1780	1810-1850	Brandenberg	2,181	181
1776-1780	1816-1850	Westphalia	2,643	114
1776-1780	1816-1850	Rhein-Province	908	90
1781-1805	1810-1850	Berlin	3,442	176
1780	1810-1850	Pommerania	1,774	130
1774-1801	1810-1850	Sweden	2,050	158
1751-1800	1801-1850	Copenhagen	3,128	286

* Hirsch. Handbuch der Geographischen Pathologie.

The Utility of Vaccination.—"The deaths from small-pox in Germany, where there is compulsory vaccination, during the years 1887–1888, were 1.8 and 0.8 per million, respectively; while in Austria, where compulsion does not exist, the deaths were 583.7 and 540.4."—*Medical Record*, April 12, 1890.

Vaccination can be very properly termed the use of a natural method of inoculation, even though the virus is not kept up by the artificial transmission of vaccina from calf to calf. It is not the discovery of man. So far as reliable information is at hand, there is no record of the discovery and actual demonstration of the true germ of variola, though the "culture of an artificial vaccine virus, by a Russian physician, which is as effective as the genuine" vaccina, was reported in the issue of January 18, of the *Journal of the American Medical Association*. This assertion must be taken *cum grano salis*, as no mention of such a discovery seems to have been made in any of the special journals of bacteriological research. So far as my memory serves me, nothing but cocci have thus far been discovered in the eruptions of variola or vaccina. I think, when discovered, that the germ of variola will be found to be a very delicate anærobic bacillus, and spore-bearing at that. Otherwise we cannot account for the long time which clothing, or other material, polluted by small-pox patients, retains its virulence. No non-spore-bearing organism that we now know of retains its virulence for such a length of time under such adverse nutritive conditions. I am also of the opinion that most of the endogenous germs will be found to be anærobic.

A Few Words as to the Objections to Vaccination.—The opponents of vaccination base their opposition upon the dangers of the transmission of other diseases with which the individual may be afflicted at the time, and from whence the virus has been derived. These objections are more applicable to the transmissions from human beings to human beings than in regard to the use of true vac-

cina directly. To my mind, however, they will scarcely hold water when we come to consider them critically. Take, for instance, syphilis. If, as is the case, it is at present impossible to positively isolate the germ of that disease or even to perform auto-inoculation save from a positive syphilitic lesion; if we cannot in any way discover that germ at present—how can it be possible to transmit syphilis from an arm or locus in which there is no syphilitic lesion? It seems to me almost impossible. The same is true of tuberculosis.

The unpleasant complications following vaccination when scabs were used, or from person to person directly, were due more to some organism which had gained access to the scab from outside or to the carelessness of the inoculator regarding the cleanliness of his instrument than to anything else.

The criminally careless manner in which vaccination is done even to-day by too many inoculators has already been noticed, and is absolutely unpardonable in these days of exact antisepsis and in general scrupulously clean surgery. In such a simple matter as this apparently is, many physicians appear to neglect precautions they deem absolutely necessary in their operations. And yet we even now frequently see erysipelatous or purulent complications follow. If the virus is properly collected, these things should never occur.

More precautions than are now used should be taken in the collection of the virus from calves. Why should all the points and instruments used not be completely sterilized? That they are not goes beyond question.

The generally favorable results following the use of vaccine points by ordinarily careful physicians shows that the danger of unpleasant complications has been altogether overestimated and magnified by those opposing this valuable prophylaxis. Still, as such does exist, it seems as if some control over these matters should be exercised by law.

The danger of using diseased heifers, especially tuberculotic, need not exist, as I know from long personal acquaintance with the senior and junior Dr. Martin, where every care is used in collecting the stock. The heifers should be collected some time in advance, and their temperature taken twice a day, and a general observation of their condition practiced. Any animal showing the least departure from normality in any direction should be peremptorily rejected.

We will now for a moment give our attention to

Pasteurism.—The world owes an unpayable debt to Louis Pasteur, for to him is due more than to any one else the reopening of the field of experimental preventive inoculation, and in directions never before thought possible of offering any practical advantages. But even he has not touched upon the most important work, which is the prevention of the non-recurrent diseases of child-life, most especially scarlet fever, which is to-day the greatest scourge that threatens humanity in civilized countries. Pasteur is an explorer in an almost unknown sea of investigation. The "gates" are still but "ajar." They are not yet open. Many others are trying to enter. Some few can glance over the threshold, but the haven of success is yet a long way off.

While I do not accept the results of Pasteur's anti-rabies inoculation, I most cheerfully credit him with his earnest endeavors and the instructive value of his success in anthrax, hen-cholera, and rouget in the hog. It may be well for me to state why I do not believe in Pasteur's method of preventing rabies.

1. There is not a particle of evidence to be found in the long historical record

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of this disease that it is non-recurrent in character. Not a single case of natural recovery in man or beast has ever been reported where the history of its origin was undoubted and the phenomena presented unquestionable. Hence we have no natural foundation to warrant the hypothetical possibility of preventive inoculation.

2. Pasteur's statistics are not honest. Not one of those Newark children was ever bitten by a mad dog. Two were left at home, and nine or ten dogs known to have been bitten by the suspected dog were kept confined over three months. Nothing ever happened to them. While the dog was "mad" enough, it was not "rabid." It did not seek to bite any one or thing, but did bite those in its way while running. It was a case of simple frenzy from an unknown cause. Dogs are often attacked thus, without rabies having anything to do with it. Pasteur still keeps those children in his statistics, though he has been fully informed as to the true nature of the case.

3. Pasteurism in connection with rabies has become a regular mania in certain parts of Europe, especially France, and rabies or hydrophobia bears a direct relation thereto. This is easily to be seen by glancing at the statistics of rabies in Prussia, for a series of years, viz.:

1876–7, 0; 1877–8, 6; 1878–9, 2; 1879–80, 8; 1880–1, 10; 1881–2, 6; 1882–3, 4; 1883–4, 1; 1884–5, 0; 1885–6, 2; 1886–7, 1.

All suspected or rabid dogs in Berlin are brought to the veterinary school. This includes every dog complained of as having bitten a human being. Of this number rabies has actually resulted:

1878–9, in 5; 1879–80, 1; 1880–1, 11, 1881–2, 3; 1882–3, 1; and none since then up to June 23, 1889, when I received my report. In the whole German Empire there were but five cases of hydrophobia reported in man in 1886, and but four in 1887.

From 1886 to 1888 there were forty cases of hydrophobia reported in Prussia, and in 1886 and 1887 only nine in all Germany.

Now let us look at the statistics given in Pasteur's Annals.

NUMBER OF PERSONS TREATED.	Rabies said to have been demonstrated surely.	Diagnosed by veterinarians.	Suspected.	Total.
December, 1888	45	77	20	142
January, 1889	32	88	22	142
February, 1889	52	90	18	160
March, 1889	42	95	32	169
April, 1889	30	122	29	181
May, 1889	28	149	36	213
June, 1889	24	115	30	169
July, 1889	19	111	38	173
August, 1889	15	97	33	145
September, 1889	15	80	16	111
October, 1889	19	88	16	123
November, 1889	20	99	16	135
	341	1211	307	1853

The majority of these cases came from France and the French possessions in Algeria. Does any sane person think that there is this vast difference in the prevalence of rabies in human beings between France and Germany? If so, I am not one of them. If so, no more striking example of the inefficiency of the French government in comparison to that of Germany in its veterinary police service and guardianship of the public health can be found.

For three years in Nebraska I vainly tried to gain possession of an actually rabid dog, and while a vast number of dogs were reported to have been bitten by such, not one would go rabid for me after it had been so bitten. I do not deny the disease. I simply deny its prevalence to any such degree as Pasteur's statistics seem to show. I simply do not believe them.

To show how unreflectingly even educated writers will quote such statistics, the following is taken from the *Times and Register*, of Philadelphia, April 12, 1890: "Pasteurism in Cuba.—At the Bacteriological Laboratory, in Cuba, three hundred and six persons have been treated by the 'double intensive, plan. Of these only two died, after going through a full course; a mortality of 1.63 per cent. All these cases were bitten by dogs proved experimentally and clinically to be rabid, *or at any rate* 'suspect.' That the operations were conducted with due conservatism is indicated by the fact than only three hundred and six were inoculated out of seven hundred applicants. The opposition to Pasteur, if it still exists, has dwindled down to an infinitesimal point."

Even in these cases, not one case was known beyond question to have been bitten by an actually rabid dog, for it is admitted that "at any rate, they were 'suspects'" only. And yet the editor says: "The opposition to Pasteur, if it still exists, has dwindled down to an infinitesimal point." "Three hundred and six" persons, scared half to death on suspicion! They were "suspects" only. We can "suspect" most anything to result from treatment based on such a "suspect" foundation. The foundation of "Pasteur's Institutes" should be treated in a most "suspect" manner. They should be treated as institutions of the utmost danger to the public. Hydrophobia, or Pasteurmania, flourishes in direct proportion to their establishment.

Since my return to this country, from that sensational visit to Pasteur with the Newark boys, a very large number of such "suspects" have come to me, or have been brought to me by physicians, to obtain my opinion as to the desirability of "going to see Pasteur." Fifty-two persons is the number I have on record, but there were a few more, notably three, since I have been in Chicago.

"Mad dogs" were very "suspect," according to the story, in each case. I talked to them calmly, ridiculed their fears, and they all left me apparently comforted. Not one went to Pasteur, and I think it can be safely asserted that no hydrophobia resulted, or I should have heard of it and the papers would have been full of it long ere this. There is a vast difference between a "mad dog" and a genuine "rabid" one. The former are frequent enough, the latter are as scarce as honest original investigators in the United States.

There is still another very strong argument against Pasteur's anti-rabidism. The germ of rabies has not been discovered. This fact in itself is not very strong negatively; but when we take into consideration that rabies is a strictly wound infectious disease in *optima forma;* or, perhaps better, toxic rather than septic; that, as in tetanus and many forms of surgical toxæmia, the toxic producers remain at the

locus traumatica, and that the poisoning of the organism takes place from there, and goes on for some time, and that constantly during that period until a certain cumulation of such material in the nervous centers has taken place—it seems to me that the Pasteur-method is self-evidently absurd. The toxic rabies element must be in solution (the nervous tissues being only saturated with it); and hence, though very abundant perhaps, still, not in such an excessively concentrated amount, in the small piece of cord used that it can produce the effect claimed. There is altogether too much dilution. If correct in the hypothesis that the toxic producer remains local, there can be no increase in the amount of poison introduced, save as made each day. The fact that the germ remains local indicates that in the trauma is the place to look for it, as in tetanus.

Again, where can I find record of one of Pasteur's artificially rabid dogs ever having conveyed the disease to healthy ones, as is the case in the actual disease, by biting?

These objections may seem too very finely drawn to enthusiastic worshipers of Pasteur, but it may yet be found that they have more foundation than appears on their face.

These objections to Pasteur on one point do not detract, however, from the importance of his work to the world in others, in the least. What may one really call Pasteurism? The answer to this question brings us at once to the consideration of

ARTIFICIAL PREVENTIVE INOCULATION, which I will discuss entirely from my own point of view, and base my remarks almost wholly upon my own work and its results. Pasteurism differs as much from Jennerism as does artificial preventive inoculation from vaccination, as practiced at present. Jennerism and vaccination consists in the inoculation of the cause of the disease to be prevented thereby, bound upon or mixed up with the produets of the disease; that is, as they are found in its specific lesion at a certain period of its development.

Pasteurism, or artificial preventive inoculation, or even inoculation in the most exact sense of modern experimental etiology, is quite another thing. Instead of introducing the cause mixed up with any products of disease, we isolate it therefrom, cultivate it, and, by one of several methods found suitable, so mitigate the virulent activity of the cause, that we can inoculate without serious danger to the individual thus treated.

It has become a generally accepted fact that all infectious diseases are due to a specific cause, which belongs to some specific species of microscopic vegetable life. The scientific class to which these objects belong is the fungi, their special name being bacteria, or, in common parlance, germs. It is not necessary to go into any description of the various varieties of these germs in an artiele of this kind; still, it is necessary that we know a little something of the manner of action of that class in which we are momentarily especially interested.

The diseases of animals in which Pasteur has been, beyond question, successful in preventing natural infection by his method of inoculation, the names of which have already been given, and to which may be added swine-plague, the yellow fever, and Texas fever in cattle, as well as typhoid fever, are all what are known as forms of septicæmia, or blood poison; ths specific poison in each case being the direct result of certain unknown physiologic action on the part of the specific germ, which causes each of these diseases. All these diseases have also

another attribute in common, viz.: they are extra-organismal in origin; that is, the place of primary development of the specific germ which causes each of these diseases is outside the animal organism, or in the earth or earthy material.

Though he has never to my knowledge stated it, still I think Pasteur should be credited with recognizing the fact that cow-pox was but mitigated small-pox, rendered, as has been said, non-malignant in character by successive generations of transmission from cow to cow in an accidental and unintentional manner. Pasteur endeavors to do this same thing intelligently. He but repeated the lesson thus learned in his first attempts at mitigating the action of the germs of anthrax, hen-cholera, and rouget by experimental inoculation in various species of animals, and he found that while in some species a given germ acquired even more virulence than it possessed when taken from an animal in which it had caused the natural disease, and kept on increasing in virulence for a time as he passed it from animal to animal of a certain species, still, on the other hand, the same procedure in another species of animal, carried on through a long series, not only caused the germ to lose in virulence, but after a time they acquired a certain standard of mildness, and could be safely used for inoculation.

This was imitating the results in small-pox. Pasteur went further! Such a method as the above is open to the very serious objection that, not only is an almost unlimited number of experimental animals necessary, but the expense would finally be such as to decidedly interfere with any practical benefits resulting. This led Pasteur and others to seek similar results in entirely different directions. They experimented in many ways, but the continued exposure of artificial culture of given germs to a certain degree of temperature, or their development in from two to two and one-half pressures of oxygen for a certain time, have given the best and most trustworthy results. A most singular fact came from these experiments, which was that when once a certain desired degree of mitigated virulence had been obtained by either of these methods, that cultivation of the same germs could then be carried on in the ordinary room temperature for an indefinite period, each succeeding generation retaining the same degree of mitigated virulence as the previous one and the mother culture. The result has shown that a preventive virus against anthrax, rouget, and hen-cholera has been successfully made by these investigators, by one or the other of methods mentioned.

For a very valuable account of Chauveau's experiments in mitigating the virulence of bacillus anthracis in this way, see *Times and Register*, Philadelphia, April, 1890.

Based largely upon the teachings and work of Pasteur nearly all investigators in this important field of research have been of the idea, and generally are at present, that a preventive virus can be obtained by the simple mitigation of the virulence of a germ of a naturally, non-recurrent disease by artificial cultivation under certain conditions of heat, or oxygen pressure, or some other method, so that the introduction of such a culture in a given amount produces simply a mild and non-fatal form of disease.

The practical results of inoculation, or vaccination, seem to confirm this idea. For myself, I was also of the same opinion, until it was completely shattered by most extensive experiences, and apparently positive experimental results.

It is but justice to myself to inform my colleagues, both investigators and physicians, that this business of "preventive inoculation" in swine-plague is not

of my own choosing; that I am bitterly opposed to it; that I feel that it is disgraceful in one being, or making any pretensions of being, a scientific investigator; that I think and know that all and every result of original research should be the property of the people; and I can truly say that, had I not the remote hope that the rewards of this distasteful business may be such as to enable me to build, equip, and plentifully endow a laboratory and hospitals for the investigation of the non-recurring diseases of child-life, where the poorest genius can have free opportunity to study and be educated, or pursue original investigations, that I would have nothing to do with it. I would not continue it for a moment, to enjoy even a handsome business income, but I hope the end desired may be obtained, and that the medical profession will eventually justify the unprofessional means on account of the worth of the object attempted.

Self-respect forced me to resign my position as investigator in Nebraska on account of three years of uninterrupted intrigue and unlimited abuse and opposition excited against me by the Agricultural Department at Washington. No other course was open to me.

This inoculation against swine-plague is a matter of more importance to the advancement of original research in this country than at first may appear to the casual observer. I can safely assert that so much success has been attained that it can no longer be open to a single doubt. Its actual practical value can only be estimated by large and extensive experiences continued for several years. Its present value and interest is, however, mainly scientific.

Having sufficiently demonstrated that inoculation will prevent swine-plague, as Pasteur's work has been the initiative incentive to all investigations in this direction, so should this result have the same value in this country, and be a stimulus to the most energetic and exact endeavors to develop protective inoculation against other non-recurrent diseases in our live stock, but even more particularly those of our own species. If my work only succeeds in putting this stimulus in such activity that work will be inaugurated and earnestly continued, and lead to the establishment of national and state laboratories all that I have labored for will be attained, and my life be pronounced a success. My interest is far more in inspiring and inaugurating true original research in this country than in my personal success as an investigator. If the last can only lead to the first then I am satisfied.

In this paper I unfortunately can only place before the world my failures, as in justice to my financial supporter I cannot publish the methods by which I have obtained success, much as it is my desire to, but something valuable can, I hope, be learned from my failures.

As has been said, I began the search for preventive inoculation in swine-plague on the principle of mitigation of virulence, so as to obtain a virus that would not seriously disturb the hogs, and yet render them immune from disease.

At this time and place I will simply reassert that this has been done and in so many places and in so many hundreds of animals that the fact is beyond the possibility of doubt.

From this non-virulent point of view the first desideratum is to obtain a virus, or culture, of a constant degree of mild virulence. As inferred above, various methods have been empirically discovered. Pasteur, as has been seen, used certain forms of animal life at first, carrying the virus from one to another of a given species in which it slowly lost its virulence until it acquired a desired benignity.

He also found that an augmentation of virulence, until it acquired an equal constance in malignity, could be produced in some other species of animals. This was too expensive a method to be practiced. He then found that the exposure of the cultures to a certain degree of heat for a certain time would also produce the desired mitigation. Others have proven these observations to be trustworthy. Chauveau works by the oxygen pressure method, and has obtained the same result. We need not discuss others.

The great fact is that once the desired degree of mitigation has been obtained in any virus that the virus thus obtained can then be cultivated in ordinary media (fluid) outside of those conditions, and that the virus thus obtained will retain this constant degree of mitigated virulence for a long time. If a spore-bearing germ, this condition may be retained almost indefinitely, but in non-spore-bearing organisms it is not so reliably constant. The first thing, then, was to obtain a constancy of virulence in the desired direction.

I have never thought that either of the above methods was strictly scientific. They are too artificial; hence, as far as swine-plague is concerned, I have endeavored to produce the same result by a more natural procedure. That is, by chemical nutrition, for this virulence is entirely a physiological-chemical result, and absolutely dependent upon the nutritive qualities of the media in which germs develop. It has been said that, once a desired degree of mitigation was arrived at, it could be retained in artificial cultures for an indefinite period.

With regard to the swine-plague germ, other investigators have not only declared this to be impossible, but also unnecessary. I shall show that it can be successfully done, but cannot, unfortunately, tell how, for reasons previously given. I think I shall also be able to show that, in a certain sense, no great result has been obtained when we have done it.

Attention has been called to the fact that others could not obtain this constancy in mitigated virulence, and, furthermore, that it was unnecessary in swine-plague

In a paper on "Hog-Cholera," which is the disease I call "Swine-Plague," one of these diletants says: "I shall not go into the details of preventive measures in this paper. * * * What you are doubtless interested in, is the new points which may have been brought out by our investigations. The most interesting of these is our attempt to confer immunity by inoculation. We soon found that there was no indication for attenuating the virus for this purpose, because the strongest virus might be introduced hypodermically, with impunity, in considerable doses. Now, as the stronger a virus is, the higher a degree of immunity it produces, you can see that there is every reason for using fresh unattenuated cultures. We made many experiments, and found that hogs might safely be inoculated with one-quarter to one-half a ccm. for the first dose, and that the second dose might be safely increased to two to three ccms., showing that some degree of immunity had been gained. Those twice inoculated, however, were still unable to stand the exposure in an infected pen, and could not be fed the virus without fatal results."—*Journal of Comparative Medicine*, Philadelphia, Pa., April, 1888, Vol. IX, p. 149.

Let us consider these statements a little. First, not only their general tenor, but that of all the subsequent publications of the same author, show, according to him, that swine-plague cannot be prevented by inoculation. It is interesting to read, in this connection, what the same authority said in 1883, five years previous

to the above, when, as can be shown, he had no idea what the germ of swine-plague was; but, supporting himself on the authority of Pasteur, he asserted a micrococcus to be that cause. Swine-plague was not discovered in France until 1887.

He said: "Our investigations have shown that the plague is a non-recurrent fever, and that the germs might be cultivated; they have even proved that these germs may be made to lose their virulent qualities and produce a mild infection. Surely we have here sufficient evidence to show that a reliable vaccine might be easily prepared if we carried our investigation but a little way farther.

"Mr. Pasteur has recently confirmed (?) our American investigations in a very complete manner. He shows that the disease is produced by a micrococcus; that it is non-recurrent; that the virus may be attenuated, and protected from subsequent attacks, and he promises a vaccine by spring."—Report Department of Agriculture, 1883, page 57.

That the above was made out of whole cloth is shown by the following:

First. A micrococcus is not the cause of swine-plague.

Second. The government knew of only one swine-plague until 1886 and a coccus is not the cause of either hog cholera or the nondescript disease it now calls swine-plague.

Third. Pasteur studied "rouget," and not swine-plague.

Fourth. A bacillus has been proven to be the cause of "rouget," and not a micrococcus.

Fifth. Pasteur's virus against rouget does prevent.

Sixth. If in 1883 this person said, "Surely we had sufficient evidence to show that a reliable virus might be easily prepared," what has become of that evidence since then? It is singular that my success in preventive inoculation should dispel it as easily as the morning sun does the fog of the prairie.

As to preventive inoculation in swine-plague I will quote the following only from my address before the Live Stock Breeders' Association of Nebraska February last:

"My only sin has been that I forestalled the ambition of the government, which, being one 'for the people,' we might suppose would be an act to receive kind endorsement rather than the most bitter and fanatical opposition.

"Even that 'Board of Inquiry' admitted that inoculated hogs stood the tests they were exposed to better than hogs which had recovered from a natural outbreak.

"Professor Burrill, in a moment of unprejudiced honesty, wrote me that 'none stood the tests so well as the Nebraska hogs.'

"With these facts publicly announced to those most and directly interested, a political neophyte, in a recent publication, claims that he has a letter from the president of that 'Board of Inquiry,' Dr. Shakespeare, in which the latter says the Nebraska hogs were equally sick, when put in a diseased herd, with a lot of healthy ones also put in the same herd. Then why did not Dr. Shakespeare tell the farmers that in the published report?

"Was it not the sacred duty which he owed to science and to every hog raiser in this country?

"On the contrary, that part of the report to which he had his name attached says, without any reservation whatever, that the Nebraska hogs stood the tests better than those naturally recovered.

"What more, then, can you ask?

"Does not that assertion of Dr. Shakespeare's, endorsed by Prof. Burrill's signature and by his latter letter, not only emphasize and confirm the reiterated statement of the government that the disease is 'non-recurrent?'

"If the inoculated hogs stood the tests better than recovered hogs from a naturally 'non-recurrence' disease, then art beats nature, and inoculation has proven to be a reliable fact, one established beyond question, no matter if an occasional failure does occur, as it has in my practice since I left you, and since I have had to entrust the business to other hands, and from the very opposition of the government, resort to an undue precaution, which, had I remained here, would never have been necessary."

To the above I add one testimonial from a practical farmer, contributed to the *Breeders' Gazette* of April 2, 1890:

"Mr. R. C. Fulton, Taylorville, Ill., writes: 'The reports in your issue of March 19, by C. A. Cantine, A. R. Hubbard, Marion Ryman, on inoculation, remind me that it is surely due Dr. F. S. Billings, also the farming world, that I should make report of my experience with two inoculated boars sent me for the purpose of proving, so far as possible, that inoculation is a preventative. The pair of hogs were received about February 8, and at once placed in the lot of about one acre, adjoining which were breeding pens for six sows. In the lot and pens named I had lost forty head of hogs, and yet had a few left when the boars were placed in pens. These hogs have continuously bedded on the same litter, and in the same pen where eight had lain while sick and dying. I have fed them on ear corn only, and that was strewn on the excrement and cleanings from other infected pens, and for drink they have had slough water, which catches the waste of barn, lot, and pens above named. This I consider a crucial test, and I felt nothing short of that would satisfy even my unprejudiced mind as to the prevention of swine-plague by inoculation. Many of my neighbors have looked on incredulously, and I was even laughed at by my more verdant ones; but the laugh ceased; incredulity has vanished, and all admit that something prevented, and what else but inoculation? For my herds have been reduced or swept away before. In conclusion, the hogs named are doing fine on the same ground where forty died.'"

Scientifically speaking, this is sufficient evidence to prove the fact.

Now, as to that irresponsible statement that "we soon found that there was no indication for attenuating the virus, because the strongest virus might be induced with impunity in considerable doses."

Whether one ccm. is to be looked upon as a "consideaable dose" or not, I will not attempt to decide, but that I can select an outbreak of swine-plague from which that dose, in the first generation of cultivation, will produce fatal effects, as well as that inoculation will prevent, is shown by the following:

In December, 1888, I desired to test a number of inoculated hogs for a special purpose. At the state penitentiary there raged one of the most malignant outbreaks on record. By malignant I mean actually fatal, not prolonged, and still fatal in its course. From one of these hogs I obtained a culture and inoculated, in the flank, seventeen healthy uninoculated hogs, and twenty inoculated ones, with one ccm. of the first culture. Fifteen of the uninoculated pigs died, and all were sick. The others were not affected at all. Cultures from the original penitentiary hog, and from several of those which died, with full autopsy notes, were sent to Professor Welch, of Johns Hopkins.

This, then, shows that "considerable doses" of the strongest virus cannot be used with impunity, and also that immunity can be produced by mitigated cultures, as none of the inoculated hogs were made seriously ill during their treatment.

The germ of swine-plague varies much in acuteness of virulence, as every one knows, and this is shown in nearly every outbreak one studies. Rabbits have been considered to be suitable animals to control this point, of which one observer says: "Rabbits die from hog-cholera inoculations in six to nine days."—*Journal Com. Med.*, e. c., p. 133. On this point Welch says: "The duration of life after inoculalation of rabits is usually from five to fourteen days, and it may be even longer." —*Journal Com. Med.*, Vol. I, 1890, p. 52. "Rabbits when inoculated die usually in six to eight days."—*Bulletin, Johns Hopkins University*, December, 1889.

In an attack upon preventive inoculation, made by a tool of the government before the Kansas Board of Agriculture, we find the following interesting passages.

1. "Prevention by inoculation depends upon the well-known principal that one attack of a contagious disease generally protects the individual from the subsequent attacks of that contagion. All individuals, however, are not protected in this way from any disease, and in many cases the protection only lasts for a short period."

Comment is unnecessary.

2. "The dose is the only factor which must be considered when inoculating. The strength of the virus varies in different outbreaks of the disease so much that the dose, which would be perfectly harmless in one case, would be as certainly fatal in another. As there is no reliable test of the strength of virus, but experiments upon hogs, and as the strength varies during artificial cultivation, you will see that it is next to impossible to accurately know the strength of the virus he (Billings) is using."

3. "Inoculation in practice consists in injecting under the skin as much of the strong virus of hog-cholera as can be safely given without producing a fatal type of disease. It must be remembered that inoculation is very different from vaccination. The virus used in inoculation is the same as is found in hogs dying of the plague, while in vaccination a virus is used so weakened that it cannot cause a fatal disease. No method of vaccination has yet been introduced for hog-cholera. It is inoculation that is being advertised as a preventive for hog-cholera, and it is the question of the size of the dose whether the disturbance produced in the hog's body is mild or fatal in character."

From all that has been quoted from these authorities it is evident that they have no idea of a constancy of virulence in the swine-plague bacilli, or that such can be obtained.

It has already been stated that in Pasteur's and other methods of mitigation, when a certain desired degree of mitigated virulence had been once obtained, cultures of the same degree could be then carried on for an indefinite period.

This led me to the study of the following questions:

1. Is there a mitigated or non-fatal degree of virulence to be found in natural outbreaks? or, in other words, can a vaccine virus be at once obtained from a natural outbreak? This I proved to be an unquestionable fact easy of demonstration at any time, though it took much study and very close observation of the

relation of certain pathological lesions to the desired degree of virulence to obtain the knowledge, and some experimentation to prove it.

2. Can this or any natural degree of virulence be retained indefinitely by any method of artificial cultivation by nutritive measures alone?

3. Can this micro-organism be fed up and down in virulence by changes in nutrition alone.

4. Can a direct proportional relation be established between a certain dose of virus of known virulence in small animals and a safe or preventive dose of the same virus in hogs?

The three last questions have all been solved in a most exact and satisfactory manner.

It is possible for me to almost invariably select an outbreak of swine-plague from which a given dose of the first cultivation will kill a rabbit on subcutaneous inoculation in approximately four days, and, by a very slight variation in nutrition, to bring and retain such a virus to this point of virulence in a very few generations.

In order to demonstrate this point, I will give the result with several viruses:

Virus No. 1.			Virus No. 2.†		
Generation.	Date of inoculation.	Killing time, days.	Generation.	Date of inoculation.	Killing time, days.
1	Sept. 28, 1888	4	1	Sept. 28, 1888	4
35	Jan. 5, 1889	4	77	Oct. 5, 1889	4
76	Oct. 2, 1889	5	78	Oct. 13, 1889	3½
78	Oct. 16, 1889	4	79	Oct. 16, 1889	4
79	Oct. 23, 1889	4	80	Oct. 23, 1889	3½
80	Oct. 30, 1889	3½	81	Oct. 30, 1889	3½
81	Nov. 10, 1889	4	82	Nov. 10, 1889	3½
82	Nov. 17, 1889	3½	83	Nov. 17, 1889	3½
83	Nov. 25, 1889	4	84	Nov. 25, 1889	3½
84	Dec. 2, 1889	4	85	Dec. 4, 1889	5
85	Dec. 9, 1889	4	86	Dec. 11, 1889	3¾
90	Jan. 26, 1890	4	90	Jan. 10, 1890	3¾
93	Feb. 22, 1890	3½	95	Feb. 22, 1890	3½
95	Mar. 9, 1890	2¾			
98	Mar. 31, 1890	6*			
99	April 6, 1890	4			
100	April 13, 1890	4			
101	April 20, 1890	4			

* This rabbit had survived a very delicate inoculation, made on 16th of March.
† From an outbreak on another farm.

Virus No. 3.			Virus No. 4.		
Generation.	Date of inoculation.	Killing time, days.	Generation.	Date of inoculation.	Killing time, days.
1	Oct. 2, 1889	4½	1	Oct. 3, 1889	3
2	Oct. 9, 1889	3	2	Oct. 9, 1889	4
3	Oct. 16, 1889	3	3	Oct. 16, 1889	4
4	Oct. 23, 1889	4	4	Oct. 23, 1889	4
5	Oct. 30, 1889	4	5	Oct. 30, 1889	3½
6	Nov. 10, 1889	3½	6	Nov. 10, 1889	4
7	Nov. 17, 1889	3½	7	Nov. 17, 1889	3
8	Nov. 25, 1889	4	12	Dec. 24, 1889	3¾
9	Dec. 4, 1889	3¾	13	Jan. 1, 1890	3¾
10	Dec. 11, 1889	3½	16	Jan. 26, 1890	3¾
11	Dec. 18, 1889	3½	20	Mar. 2, 1890	3½
15	Jan. 19, 1890	3⅛	21	Mar. 9, 1890	3
19	Feb. 22, 1890	3½	24	Mar. 31, 1890	3¾

Virus No. 5.			Virus No. 6.		
Generation.	Date of inoculation.	Killing time, days.	Generation.	Date of inoculation.	Killing time, days.
1	Dec. 19, 1889	2½	1	Jan. 30, 1890	2¾
2	Dec. 24, 1889	2½	2	Feb. 2, 1890	2½
3	Jan. 1, 1890	4	4	Feb. 22, 1890	3½
4	Jan. 10, 1890	4	6	Mar. 9, 1890	4
5	Jan. 19, 1890	4	9	Mar. 31, 1890	4
6	Jan. 26, 1890	4	10	April 6, 1890	4
8	Feb. 22, 1890	3½	11	April 13, 1890	4
13	Mar. 31, 1890	4½			

From the first generation of this virus No. 5, seven healthy hogs received one cubic centimeter in the inside of the thigh subcutaneously; two of these died which were closely confined, within ten days; and others were at first loosely confined, and showed no ill effects; but after the fifteenth day they were changed to the closest confinement possible, and all died between the thirtieth and thirty-fifth days; while five others, which were given plenty of room to roam about, and which received the same dose, all lived. This experiment was made to demonstrate, if possible, a certain well known fact of practical experience.

It has always been told me that if such hogs were shipped that the death rate would be checked, or even stopped, while on the cars; and it has also become more or less current among farmers that to put sick hogs on a wagon and rattle them over frozen and rough ground was a good thing to do. In some few cases evil results have followed inoculation. Some few hogs have either died after a prolonged illness or become somewhat stunted; while others, inoculated with the same dose, of the same virus, have shown no ill effect. It therefore becomes an interesting question to discover why this should occur in one case and not in a great many others.

After a very careful inquiry it was discovered that, where ill effects followed inoculation, the animals were kept very closely confined, and had not room enough to move around, and that this was the cause; or, in other words, insufficient movement to stimulate the circulation. A very striking example of this occurred in two bunches of hogs inoculated at the same time for a gentleman who is a personal friend and a great advocate of inoculation. At his house were twenty-five hogs in a small pen, while in a field running with his cattle were about one hundred and twenty-five others. Those in the small pen had a prolonged and very severe attack of swine-plague in consequence of the inoculation, though none died; while the one hundred and twenty-five in the field showed no ill effects whatever.

Exactly the same thing occurs in typhoid fever in man; the patient has recovered from his typhoid and the physician congratulates him; the next day he is cyanotic, rapid breathing is present, and pneumonia develops; owing to stagnation of the circulation, and the reflow or pressure of the blood to the point of least which resistance, is the lungs.

The above tables show that a standard of virulent activity can be produced in cultivations of the swine-plague germs simply by proper nutrition. They further show that not only the selection of material from a natural outbreak can at once provide a preventive virus, but, also, that, in successive cultivations for generations, this standard can be retained at a greater degree of virulence than other observers claim to have found in natural outbreaks by their controls in rabbits.

Now, I must positively, and against every and any assertion to the contrary, assert that I can prevent swine-plague by inoculation. Were I not bound as I am I would give records of other viruses possessing no virulence whatever, which have produced and still produce an absolutely immune condition in nearly every hog inoculated.

To discover this fact has cost an immense amount of experimentation and a large amount of money. There is one difficulty about it which cannot be overcome. While the virulence of a culture can accurately be tested on small animals, and the exact relation be established between that virulence and a safe dose in the animals in which a given non-recurrent disease occurs naturally, we have no means of testing the preventive properties of a virus, except the results in inoculated animals of the species in which the disease naturally occurs, and this takes a long time and a great many inoculations.

When I began this work I thought that a test of virulence, with a proper regulation of the proportional dose, was all that was necessary; now I know that a test of virulence with such proportional control is of no value whatever with reference to the protecting power of a given virus. I know this by an experience in over one thousand five hundred hogs. Either one of these six viruses named above will kill a hog by subcutaneous inoculation in sufficient doses, but more reliably by feeding experiments; yet not a single one of them will protect a hog an iota against the cholera; while a germ virus, without any virulence whatever, even by forced feeding, will protect securely and almost invariably, in single doses of one cubic centimeter.

This assertion is obviously contradictory to all previous experiences, and yet, if one stops to think a moment, supported by the most trustworthy experiences which we have.

There is no question that, under certain circumstances, using a natural virus, we must reduce the virulence to a certain degree in order to produce a fatal attack by inoculation; but, on the other side, we do not need to have a virus possessing any virulence whatever to produce immunity in a non-recurrent disease.

Vaccination gives the best possible example of the point we desire to call attention to. While in variolation small-pox itself was transmitted, and the variolated person was as much a source of contagion as one having the natural small-pox, the vaccinated individual is absolutely non-dangerous to those coming in relation therewith.

What has been lost?

Certainly something; and the practical evidence conclusively demonstrates that it must have been, or is, that peculiar element of the germ, the contagion, which rendered the variolated person dangerous while the vaccinated one is not.

It is a question of nutrition only, which can be demonstrated by exact experimentation if we only try.

The bovine organism must offer certain nutritive conditions which, in some unknown way, rob the micro-organismal cause of small-pox of its contagious (small-pox) producing qualities, while the preventive one is retained in *optima forma.*

The same thing can be done with the germ of swine plague, but to no such degree of absolute certainty as nature or accident has accomplished in vaccina. While it is the easiest possible matter to feed the germ of swine-plague up and down in virulence, to make it extra malignant, or rob it of that quality altogether

by changes in the chemical nutrient, it is a most difficult thing to retain the preventive physiological qualities of these germs. Sometimes it can be done for months, and again they are lost in a few generations; but we have no control over these matters except the practical tests. None of the small animals which I have tried can be easily or successfully rendered immune against swine plague. Rabbits and guinea-pigs can be rendered somewhat immune by repeated inoculations of small quantities of virus; but, so far, I have been unable to render them absolutely so. Pigeons vary; but no more artificial immunity can be produced in them than they naturally have, as will be shown later, and at another time.

As has been repeatedly mentioned, a test or control of virulence has nothing whatever to do with the protective power of a virus. It simply shows that it is safe to use, and that we can establish the point of safety by experiment.

This shows that we have been working on an erroneous basis. Prevention has no relation to specific virulence. Others have demonstrated the same fact.

In *The Times and Register*, Philadelphia, of April 12 and 19, were published a series of most interesting experiments by Chauveau, the most eminent and conservative experimenter in France, in which he demonstrates it in connection with bacillus anthracis. Chauveau says * that "Energetic vaccinal (preventive properties have been discovered in a pathogenic germ (*B. anthracis*) not only attenuated in its virulence, but systematically deprived of all infectious properties—rendered so neutral and inactive that we were forced to ask ourselves if this transformed microbe had not become a new species."

"Cultures of bacillus anthracis in this condition can then be carried on in the ordinary atmosphere."

Chauveau conclusively shows that bacillus anthracis produces two chemical elements in its bio-physiological development; the one toxic, or specifically disease-producing; the other having exclusively preventive properties; and that, by cultivation in two to two and one-half pressures of oxygen, the toxic properties may be or are lost, while the preventive are retained. Or, to use his own words, "In fact, in my experiments the vaccine property of the transformed bacillus anthracis is so active and so well survives the loss of infectious properties, that we seem authorized to consider these two properties as being absolutely independent of each other, and as each belonging to a special product of microbe life."

Another point in evidence of this fact is this: if we take a culture of the germ of swine-plague which has experimentally been shown to actively possess both of these preventive and toxic, or disease-producing, qualities, by actual experimentation, and freeze it solidly for several days, and then inoculate or feed hogs with it, we will find that, while it retains its toxic, or disease-producing, properties without mitigation, it has entirely lost its preventive properties.

That bacillus anthracis has the power of producing these two essentially different chemical elements has also been well shown by Hueppe and Wood.

Though I sometimes criticise the conclusions of my friend Hueppe, still I think him one of the most competent and reliable patho-bacteriologists living, especially in regard to physiological-chemical attributes of patho-genic bacteria. In the publication mentioned Hueppe and Wood describe a saprophytic bacillus absolutely without virulent qualities, which, in every method of artificial cultivation, or under the microscope, bore such close resemblance to B. anthracis that it could not

* The original appeared in *Archives Med. Experimentale*, March, 1889.

be distinguished from that organism. It is a well known fact that all previous experimenters had not been able to render mice immune to anthrax by any system of preventive inoculation; and yet, with this absolutely non-virulent germ, Hueppe and Wood were successful in rendering these most susceptible animals immune to extremely virulent cultures of bacillus anthracis.

Now, it is neither logical nor reasonable to suppose that this was any other micro-organism than bacillus anthracis. It was derived from the earth, possessing exactly the attributes described by these observers. In this case the nutritive conditions in the earth had naturally produced exactly the same physiological-chemical conditions in bacillus anthracis which Chauveau has conclusively demonstrated to be possible of production by the cultivation of the same germ under certain degrees of oxygen pressure, and I have been able to do with the swine-plague germ by chemical nutrition, the only difference being that while I have, as it were, "gone it blind," not being a a chemist, and accidently hit on a means of arriving at a certain practical result, by innumerable changes in chemical nutrition until I have empirically arrived at a method of obtaining a certain result for an uncertain length of time, Chauveau has found a definite means of obtaining it with reference to the bacillus anthracis.

That the chemical nutrition method is the one by which practical results will eventually be obtained goes without question; but it remains for the chemist alone to really discover and perfect it.

The discovery of Hueppe and Wood regarding bacillus anthracis finds its confirmation in many diseases of extra-organismal origin, and explains that heretofore mysterious condition known as "acclimatization" in diseases of this character: such as yellow fever, Southern cattle plague, etc. In these cases the specific germs, in a saprophytic or non-malignant condition, must have gained entrance to the individuals possessing this acclimatization immunity while they possessed this prophylactic power, though not possessing the toxic or disease producing.

That all these exogenous germs are, or can be, changed to saprophytic must be self-evident; and that their toxic or disease-producing property is acquired by peculiar nutritive conditions in the soil which they naturally inhabit seems also equally clear. In fact, their acquisition of disease-producing qualities is dependent upon the prolonged saturation of the ground with the excreta of animal life or the decayed products of animal tissues. The delicacy of the action of these germs in different nutritive media is so little understood, and has enjoyed so little experimentation, especialy chemical investigation, that we really know very little about it; yet it is the open field of original research which will eventually lead to success, and from which we can only hope for decidedly practical results.

Why the swine-plague virus should lose its virulent properties in cattle, or even when cultivated in sterilized cattle urine, is a question no one can decide at present. Why the germ of the corn-fodder disease should not be toxic to animals while still manifesting its presence by specific lesions in green and growing corn, and only become toxic when and after the leaves begin to wither and the chlorophyl suffers chemical changes, are also questions of a nutritive nature which can only be elucidated by the most exact chemical investigations.

At one time in their existence all these organisms are saprophytic, and again they become pathogenically toxic, all of which is determined by the material they develop in.

Before closing, I desire to say a word in relation to fluid-cultivating media. When the study of bacteriology first began, these were the only media we had, and it was next to impossible to obtain perfectly pure cultures for the want of a reliable means of isolation. Koch supplied us with this means, but, in doing so, led to an altogether too great neglect of fluid media, which has retarded investigation to a degree not sufficiently estimated by the majority of the investigators.

Once it was thought that the only way by which pure cultures could be legitimately attained was by the isolation method offered by the solid media on plates, according to Koch. Now we know that, in the majority of cases, if we inoculate a susceptible animal with material containing a variety of micro-organism derived from an animal having a specific disease, in general, the germ of the latter only will develop; and that, from the specific lesions, we can generally obtain the specific germ in a pure condition if we take the necessary precautions. It is singular that the lesson of this experimental experience has not made more of an impression upon investigators. Why is not the same rule applicable to animals or individuals afflicted with the natural diseases? In other words, why not pathologically decide which is the specific lesion in a given disease, and by experience discover the period in which it is truly specific, and then make cultures directly from it at that time? This point decided, pure fluid culture can be almost as easily and surely obtained in septicæmic diseases as by recourse to solid media.

In swine-plague, Southern cattle plague, and the cornstalk disease, all septicæmic in character, I have invariably used fluid cultures in connection with the solid and with equally successful results as to purity.

The virus No. 1, to which attention has been called, is now in its one hundred and second generation: that is, it has been carried on successfully through about one hundred fluid cultures without one single pollution occurring during all that time. We must resort to fluid cultures if we will be successful in preventive inoculation, for this procedure is one, as well as virulent inoculation, which depends entirely upon the chemical food offered, and only with fluid media can we experiment in that direction or prepare the way for the chemist. Germs which soon lose their virulence on or in solid media retain the same indefinitely in appropriate fluid cultures. Starting with a pure culture, there is no more danger of pollution in the transference from fluid media to the same than in solid media, if one is rapid and dextrous in his manipulations. It is simply a question of strict sterilization and rapid dexterity which gives satisfactory results in either case.

Let me again say that it is only from nutritive experimentation with chemical fluid media that we can arrive any satisfactory results.

HOW TO MAKE INOCULATION PRACTICAL.

Every swine raiser is in earnest in wishing for some means of preventing or curing swine-plague. There is no doubt on that question. That a preventive has been found in inoculation is a fact so well sustained by hundreds of practical experiences that to throw doubts on it is to face the flattest contradiction. The question is, can it be made practical, or more practical, for the farmer than it is now? It can. The method which has always been used is the subcutaneous (under the skin), injection of fluid cultures of the germ of swine-plague obtained from actual

outbreaks of the disease, but only from such outbreaks as present a mild and slightly fatal character as it runs through a herd of hogs. The slower the course of the disease, the smaller the fatality in a herd, the better suited are such animals to obtain the cultures from out of which is made the virus for inoculation. From the very first I have always taught that an inoculated hog passes the germs of the disease off with its manure, and hence, could resow a place already infected, which, self-evidently, can do no harm. I have always insisted that hogs on places where the disease has never existed should not be inoculated for the same reason; that is, such places would then become infected. Of course, when the disease is all around such a place, on adjoining farms, no sensible man should hesitate about inoculating his hogs, but then he must keep it up every year after that, for he has thus put his hog-yard into exactly the same condition as if he had had the disease upon it in a natural manner. In districts, as in the western part of this state, where no disease has ever existed, inoculation should be positively forbidden, and no virus will be sent to any one residing in such section, so far as we can inform ourselves in the matter.

The fact that inoculation will certainly sow the yards or pens with the germs of the disease has, in the past, been most wrongfully used as an argument against all inoculation by the United States Department of Agriculture. They thus endeavor to damn and ban its use by every farmer, no matter what the conditions of his hog-yards were; no matter if they were so pestiferous that he could not safely place swine in his yards. Still he must not inoculate because of this dangerous method. Every experienced farmer knows, however, that once infected neither inoculation nor anything else can render his premises any more dangerous than they are. What then must be the surprise of any one not fully acquainted with gyroscopic intellects of the bureau of animal industry when he turns to the report of the Department of Agriculture, lately issued for the year 1890 and finds the government actually recommending the very method it has always bitterly opposed; but more, recommending it to the hog raisers of the country without any reserve whatever; without even one word of caution against its use upon places where no disease has ever existed. What can farmers think, I again say, when they see this method recommended for a wholesale application in a way previously condemned as almost criminal, and in a way that we absolutely refuse to countenance? But this has been and still unfortunately is the way the agricultural department treats the farmers of this country. Its stock in trade, the power by which it exists, is that the farmers are all idiots and either do not read its reports or do not remember the contents of the reports from year to year, and certainly never compare them. In the report of 1889, inoculation was condemned and every argument or statement possible, utterly regardless of the truth, was brought forward against it. In 1890 we find the method that has been constantly in use in Nebraska all over the west, so far as any method has been used, that was so severely condemned in 1889 (making use of my own objections, which have been stated, but fall to the ground on infected lands) most emphatically recommended, as follows:

"The method of subcutaneous injections of culture liquids containing hog-cholera bacilli, while fraught with the possible danger of scattering disease germs where they do not originally exist, is nevertheless the simplest and cheapest method that can be devised for the vaccination of animals."

That is certainly endorsement enough for the method, coming as it does from its most bitter opponents.

The reason I once opposed its general application was that I was then in hopes a method absolutely free from any objections could be found by the isolation of the chemical products of the germs and using those products free from germs. I long since came to the conclusion that such a method was too complicated and expensive ever to have any practical value whatever, though as a scientific curiosity I think it can be done in a few hogs. Hence, we must have recourse to the "fluid cultures" as the "simplest and cheapest method that can be devised."

Every intelligent farmer can prepare his own virus and inoculate his own hogs. That is what I say. The government says quite the other thing. In its latest attack on our endeavors to aid the swine dealers of the country, but especially those of Nebraska, the government says it "does not believe that inoculation could be safely trusted to the use of the average farmer, or, for that matter, to the average veterinarian."

This statement is like the majority of those emanating from the same source, absolutely without foundation and valueless. It is contradicted by the actual experience of hundreds of farmers who have inoculated their own hogs and are still doing it, and have never seen a single case of injury to their hogs. That statement is so absurd that it needs no further consideration. I now intend to go further than I ever have, as I am confident in the correctness of my sentiments, and desire that the farmers of Nebraska shall learn how to make their own virus. In other words, I propose to supply them as fast as they can be instructed with the uninoculated beef soup bouillion ready for use and the platinum wire to inoculate the soup with. Having these things and the syringe and needles on hand, and following exactly the directions to be given (instruction will be given at the laboratory to those desiring it) inoculation can be made a most practical success and need never fail. The best proof of the value of a thing is its simplicity.

We will assume that Mr. Charles Walker (who knows all about it), one of the best known farmers in Nebraska, has the vials of soup and the wire in a glass rod on hand and desires to inoculate his own hogs. What does Mr. Walker do?

First. He looks around for outbreaks of swine plague and selects the mildest one he can find, and above all things avoids one that is killing a large number of hogs in the herd and doing it anywhere from one to ten days. The greater the number of deaths in a herd and the shorter the period of illness, the more unsuitable is an outbreak to obtain virus for inoculation from. Whereas, the smaller the number of animals ill, the slower the course of the disease in such, the better is such an outbreak suited to obtain virus from.

Second. From the last kind of an outbreak Mr. Walker selects a pig or hog just taken ill, and not one that has been sick some time; remember this; the animal to be taken must not have been sick long, for the sooner after it is observed to be ill the virus is taken the more reliable it will be. Chronic cases are useless (no dead ones must be used), and kills it by a rap on the head (not by bleeding). We must keep all the blood in the animal. He lets the animal lie until dead and then takes a good knife and cuts open the skin from between the jaws along the belly to the tail. He then cuts the skin away from the body down both sides, but in the vicinity of the forelegs cuts away the latter carefully, for if he cuts too deep down, where they are attached to the body, he will cut the large blood vessels which en-

ter the forelegs and thus bleed the animal, which he does not want to do. He then cuts the abdomen open in a straight line from the posterior end of the breast bone to the hind legs, but is careful not to cut the intestines. With the abdomen or its contents he has nothing further to do, but he must open it in order to open the breast cavity, which he does by cutting across all the ribs and muscles about two inches each side of the breast bone, which he then separates from the diaphragm, a partition between the chest and abdomen, and lifts off the breast bone and bends it back towards the head, thus exposing the contents of the chest, but especially the heart.

Third. The heart has two main chambers, called ventricles. The one, the left, has very thick, solid walls; the other, the right, has thin and flabby walls. He twists the heart a little so as to bring this thin side up. He then puts some absorbent cotton or a piece of sponge into a tin box and fills it full of alcohol, which he now sets on fire. Naturally, he must have his hog where the wind does not blow, and as no blood need be let out, it can be done on the kitchen table. After lighting his alcohol, Mr. Walker takes a cheap kitchen knife and heats it hot in the flame and then burns over the outside surface of the right side of the heart, the thin wall. Next he takes a small knife, and this must have a thin blade, and heats that and then cuts and burns a slit through the thin wall of the heart until the blood flows out.

Fourth. How to inoculate the beef soup: It has been said that the laboratory will supply farmers with this soup in flasks all ready for use, and also with an inoculating wire and syringe. The inoculating rod is made of a piece of platinum wire fastened into a glass rod. Mr. Walker now passes this glass rod a few times through the alcohol flame and heats the wire in its end red hot, then he lets it cool a moment and removing the cap from the flask he loosens the glass stopple; then he dips the point of the wire, which has a little loop in its end, into the blood in the heart through the slit he has cut, and quickly introduces the wire into the soup, putting the stopple in at once. This he repeats three times, removing and replacing the stopple each time. He now puts the glass cap on the flask and sets it in the kitchen in a safe place for three or four days. Each flask contains soup enough for 100 grown hogs. The germs at once begin to multiply and soon the previously clear soup becomes clouded and milky, if the germs are in it, which will occur in nearly every case. At the end of three or four days it is ready for use and should be used as soon as possible; after that, though, it will be good for ten days from the time the soup was inoculated.

Fifth. Remember this: This first generation is the best and most reliable virus. Up to four transfers, made weekly, that is new soup in fresh bottles being inoculated each week from the flasks previously inoculated, the virus can be depended upon, but not later. The first generation, however, is the best, and can thus always be had by the farmer, and can be absolutely depended upon to prevent swine-plague after thirty days or even less have passed since the hogs were inoculated.

If farmers will interest themselves and inoculate in this way we will supply them with the necessary soup in flasks ready to use, the inoculating wire in the glass rod and the necessary syringe and needles, but should either demand that they deposit their value with us until returned, or we will sell them the syringe and glass at cost. They can then return the empty flasks, when used, and receive

freshly filled ones and thus always have the necessary implements on hand to inoculate their own hogs, We shall expect that they will send us notice of all the hogs they inoculate and of the results, good or bad, so that we can publish the same.

If the farmers of a district would select a man to come to Lincoln and spend but one day he can be so instructed that he can go home and be able to teach others the whole procedure. This should be done.

They need not be afraid of injuring their stock, or stunting their growth, and we now know there is neither necessity nor danger of doing so when the virus is obtained in the manner directed. The whole operation is so simple and easy that I feel assured the farmers of the state will take hold of it and demonstrate its value to the world and thus boom Nebraska.

DIRECTIONS FOR INOCULATING THE HOG.

First—No hogs or pigs should be inoculated except on premises on which swine-plague has prevailed in previous years.

Second—It is absolutely useles to inoculate swine when already diseased, as inoculation of hogs, like vaccination of children against small-pox, must be done before the disease attacks them.

Third—While the virus and necessary implements will be supplied to any farmer or breeder in Nebraska free of charge, except that such farmer or breeder must pay the express charges on the same from Lincoln, and for the return of the implements to Lincoln, still any person who neglects to return said implements, or is discovered sending virus ordered by him outside the state, will be shut off, and in future shut off from the privilege of obtaining virus from this laboratory.

Fourth. In the box will be found a flask containing the virus, which must be used within the limit of time designated. Shake the flask well before using. Pourout some of the contents into a clean tea cup or some convenient vessel.

Fifth—With each flask will be found a glass syringe with a cap on the end. Unscrew the cap and fill the syringe with hot water and let it stand a few moments, or fill it several times; then screw on one of the accompanying needles and squirt out the water; then prove the syringe by filling it through the needle, and after squirting the water out fill it with virus from the cup and it is ready for use. After using wash out with hot water, unscrew needle and put the wire in needle again, and screw the cap on the syringe.

Sixth—The dose for pigs three to four weeks old, one-quarter of a syringe; three to five months, one-half syringe; old hogs, one syringe, unless otherwise specially directed.

Seventh—How to Handle the Hogs.—Young stock can best be handled by lifting them by the hind legs and holding them between the knees. Old stock should be laid on the side and strongly held. Care must be taken not to use violence and thus lame the pigs. This done, introduce the needle of the syringe through the skin of the inside of the hind leg, and then push it, until in along under the skin and not down into the flesh; then squirt in the indicated amount of virus, and let the hog go. One hundred can be easily done in an hour, with the necessary help to catch and hold them.

Eighth—No change of food is necessary.

Ninth—The stock cannot be considered to have been inoculated until thirty days after the operation.

Tenth—Return the box and implements as soon as possible after using.

Eleventh—Be sure and fill out the enclosed register.

FRANK S. BILLINGS, M. D.,
Director.

CONTINUED EXPERIMENTS IN THE CULTURE OF THE SUGAR BEET IN NEBRASKA.

BY H. H. NICHOLSON, A. M., AND RACHEL LLOYD, PH. D.

This bulletin is a report of the results reached in the sugar beet experiments during the season of 1890. It is a continuation of Bulletin No. 13, and may be considered as a second report of progress. The *chief* point in last year's work was to determine whether or not our Nebraska grown beets were rich enough in sugar to make possible a successful beet sugar industry in the state.

Incidental to this we sought what information we could get in regard to the tonnage yield and cost of production. With this statement of the objects it will be seen that the results of the work of last year *pointed* to very favorable conclusions. We speak thus guardedly in reference to these results because no one would expect to base final conclusions on the facts obtained in one season's work. A further need of caution arises from the fact that these beets were raised in a comparatively new soil and by persons almost wholly inexperienced in the best methods of cultivation.

That we might not seem to base our conclusions on insufficient data, and with the hope of avoiding many of the difficulties that met us in our first year's experience, it was thought best to repeat, during the season just passed (1890), the same work, with the further idea of extending it, if possible, into every county of the state, and, at the same time, to so deepen and broaden it that it might include many facts touched upon the first year. The campaign as planned for this season contemplated:

First—The establishment of sub-stations at convenient distances on the main lines of the Burlington, Union Pacific, and the Elkhorn railways.

Second—Reaching and interesting the best farmers in each county by seeking the co-operation of the various county agricultural societies.

Third—A general co-operation with as many of the individual farmers as possible throughout the state, irrespective of locality.

By these means we expect to bring together a large number of valuable facts regarding the points of sugar content, yield, and cost, as well as to add to our knowledge of the variations due to the different soils and climatic conditions.

The location of sub-stations was conditioned on two facts:

The finding of men of sufficient public spirit to give us the use of plots for planting and who would agree to prepare the ground, plant, cultivate, and, in general, take care of the beets according to directions given them.

The second condition in making locations was the one of accessibility, as it was our intention to visit each station at least once a month.

At the sub-stations we planted four varieties of seed; each variety in a plot ten

feet square and in rows sixteen inches apart. The beets in the rows were to be thinned to various distances. We also supplied each sub-station with a standard rain gauge and two thermometers, one for the air and the other for the oil temperatures, together with printed directions for observing the same and blanks for reporting tri-daily observations.

In order to secure the best results from these sub-stations the Experiment Station appointed three field agents from young men who, because of their work in the chemical laboratory, had some knowledge of the requirements of the case. The duties of these agents were to visit the sub-stations periodically, to see that the directions were being carried out in regard to taking observations, cultivating, etc. They were also required to report monthly, in writing, to the home station the exact condition of affairs at the sub-stations.

These field agents were also carefully instructed in the methods of taking specimens of soil for analysis and were directed to take samples from the beet plots at each sub-station. The samples were forwarded to the chemical laboratory to be analyzed and studied when time permitted.

Sub-stations were located in accordance with the above mentioned plan at Red Cloud, Orleans, Benkleman, McCook, Holdrege, Grant, Elwood, Minden, Hastings, Kearney, Lexington, North Platte, Ogalalla, Sidney, Kimball, Crawford, Alliance, Thedford, Broken Bow, Ravenna, Norfolk, Neligh, O'Neill, Valentine, and Chadron. Besides these, which formed a visiting circuit, we added Grand Island, Schuyler, Ashland, Omaha, West Point, and Bancroft, from which more or less regular reports were received. That we might be certain of reaching in as effective a manner as possible each county in the state, the following circular was printed and mailed in April to the addresses of the secretaries of each county agricultural society, as taken from the last premium list of the State Board of Agriculture:

"DEAR SIR: During the past year the University has given some attention to the question of raising beets in Nebraska for the manufacture of sugar. The results of this work are published in Bulletin XIII, Experiment Station, a copy of which has been forwarded to your address.

"We intend to continue the investigations this season, in order to reach definite conclusions on several essential points, viz.: average percentage of sugar in beets; percentage of substances not sugar; yield; cost; effect of soil, climate, and cultivation on the ratio of sugar to the other substances present. It is also very desirable to obtain accurate records of the temperature of the air and of the soil, together with exact measurement of the rainfall.

"To make this work more complete we desire to have beets of two or three varieties raised under our direction in each county in the state. Will you name a man who will take seed, plant, and cultivate it according to directions, and report results? Seed, full directions for planting and cultivating, as well as necessary apparatus, will be furnished by this department. Each station thus established will be visited, if possible, at least once during the season."

Many of these circulars brought prompt responses and assurances of hearty co-operation. It was the intention to observe about the same line of investigation in these cases as at the sub-stations. It was expected also that some member of the station staff would be able to visit each county station at least once during the season. It was found later that this would be out of the question, as it required all the time to reach the sub-stations and keep up the office and laboratory work.

Outside of and beyond the plots provided for by these means, seed was put in the hands of about 2,000 farmers, representing all sections of the state. In each case full directions were given for cultivating, and answers to a certain line of questions earnestly solicited.

Such in brief was the general plan of the work as we entered upon it this season. This plan was carefully followed out in all particulars, except such as were made impossible by lack of time or assistance.

SUB-STATIONS.

To avoid much useless repetition in describing the work of the season and giving the results, the sub-station may be roughly grouped into southern, middle and northern districts.

The southern district includes that portion of the state along the Burlington railroad south of the Platte river and west of Lincoln.

The middle district comprises that portion of the state north of the Platte river adjacent to the main lines of the Union Pacific and Burlington railroads west of Grand Island.

The northern district comprises that portion of the state adjacent to the Elkhorn railroad and west of Norfolk.

The following varieties of seed were imported, by the station, direct from the growers in France and Germany and used at the sub-stations throughout the state: Vilmorin, white improved; Desprez, white improved; Lemaire, white improved; and Dippe's Klein Wanzlebener.

At each of these sub-stations plats ten feet square for each variety* of seed used were prepared by plowing or spading to a depth of ten inches. It was thought best not to disturb the ground to a greater depth, because, owing to the previous shallow cultivation, it would leave too much raw soil on the surface.

Southern District.

Work began in this district early in May. The soil throughout this entire district may be classed as a sandy loam, generally rich and deep and well drained. Along the southern branch of the railroad the stations were mostly on first or second river bottoms. Along the northern branch of the road the soils were darker and a little heavier and usually on the table-lands.

The season during March had been cold, with less than the usual amount of rainfall; April has been very warm—with one exception, the warmest April for twelve years—and with only about one-half the usual amount of rainfall for this month, except in the extreme southwestern corner of the state, where the April rainfall was about double the normal.

Seed was planted at all stations in this district between the 7th and 10th of May, in drills sixteen inches apart and at the rate of about twenty pounds to the acre.

At the time of planting the ground was very dry, except in the extreme southwestern corner of the state. In some places seed was planted in the dry dust.

The time of germination varied greatly. Where the soil was reasonably moist, in the western part of the state, plants appeared in nine days. In some cases, though, germination did not take place for a period of thirty days.

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*The reasons for preparing such small plats were, first, the amount of seed to be used was limited; second, in order not to have plats so large that the cultivation should be a burden to the farmer who gave the use of the ground.

A statement of the average temperature and rainfall for the month preceding planting, as well as for the growing season, is shown in the following table. The figures for 1890 are taken from observations made at sub-stations during the course of the season and from reports of State Weather Service. The normal temperature and rainfall is taken from the reports of the State Weather Service:

TABLE I.

Meteorological Data for Summer of 1890 (Southern District).

Months.	Temperature F.°		Rainfall (Inches).		Heat Units.*
	1890.	Normal.	1890.	Normal.	
April	55	50	1.41	2.88	1650
May	61	60.3	1.84	3.82	1891
June	76.2	73.8	3.84	4.18	2286
July	82.1	78.5	2.13	3.66	2545
August	74.5	70	2.50	3.02	2309
September	67.7	63	0.96	2.31	2031
October	52.7	52.4	0.88	1.97	1633
Total			13.56	21.84	14345

* Found by multiplying the daily average temperatures by number of days in each month.

During the summer and autumn beets were received for analysis from all of the stations located in this district.

In the table below is given the *average* results from each station. In every case the figures represent the average of all the beets sent from the station, excepting only those sent from time to time through the season and before maturity, for experimental use.

TABLE II.

Average of Results from Sub-stations (Southern District.)

Sub-stations.	Weight—Ounces.*	Sucrose—Per Cent.	Purity.
Red Cloud, Webster county	15	13.4	75
Orleans, Harlan county	9	7.3	54.9
Benkleman, Dundy County	24	13.2	74
McCook, Red Willow county	16	16.6	86
Grant, Perkins county	23	16	75
Elwood, Gosper county	12	16.6	79.6
Minden, Kearney county	16	15.5	79
Hastings, Adams county	14.5	14.9	80
Holdrege, Phelps county	12	10.8	71.5
Lincoln, Lancaster county	17	14.4	83
	15.8	14.4	75.8

* Net, after cleaning and topping.

As this bulletin is intended primarily for the farmers of this state, all weights have been expressed in pounds and ounces.

During the seven months from April to October inclusive but 13.56 inches of rain fell as against 21.48 inches normally. Table I shows also the distribution of this rainfall through the season.

During this period also the temperature was abnormally high, ranging above the normal from 0.3° in October to 5° in April, with an average of 3° above the normal during the season.

The most serious factor in the season in this part of the state was undoubtedly the frequent hot winds during June and July. Their general effect on beet culture can be estimated from the tabular statement of results from the sub-stations in this district.

Middle District.

The soil where the stations were located in this district bears a general similarity to that in the southern district. In all cases it was a sandy loam, varying from a very light and sandy consistency on the Platte river bottoms to the heavier and darker soil containing some clay on the uplands farther to the north. Previous to the planting the season had been much the same as that in the southern district, except that the months of March and April had been a little cooler with about one-third the normal rainfall.

Seed was planted at all the stations in this district between the 13th and 25th of May, in drills sixteen inches apart and at the rate of about twenty pounds of seed per acre.

The ground was, in general, in this section in better condition at the time of planting than in the southern district.

The time of germinating here, as in the southern district, varied within very wide limits; the shortest period recorded was twelve days, the longest period during which seed germinated at all was twenty-seven days; in some cases seed did not germinate at all.

The rainfall being considerably below the normal and the temperature considerably above. For a general statement of the average monthly temperature and rainfall, see Table III, in which figures for 1890 were taken from observations made at the stations and from the reports of the State Weather Service. The figures for the normal temperature and rainfall are an average of observations extending through a series of years, and are taken from the report of the State Weather Service.

TABLE III.

Meteorological Data for Summer of 1890 (Middle District).

Months.	Temperature, F.°		Rainfall (Inches).		Heat Units.
	1890.	Normal.	1890.	Normal.	
April	49.7	49.0	2.54	2.05	1490
May	59.1	58.8	2.19	2.70	1832
June	71.3	69.4	2.13	2.47	2189
July	78.2	74.6	1.34	2.86	2424
August	71.3	71.4	2.32	2.31	2210
September	62.5	61.2	0.78	1.47	1875
October	49.6	48.6	1.02	1.13	1527
Total	....	....	12.32	14 99	13497

During the season beets were received from all stations in this district except Kearney, Lexington, Sidney, and Alliance.

Table IV shows the average results from each station, excepting only those beets sent in during the earlier part of the season.

TABLE IV.

Average of Results from Sub-stations (Middle District).

Sub-stations.	Weight—Ounces.*	Sucrose—Per Cent.	Purity.
Kearney, Buffalo county			
Lexington, Dawson county			
North Platte, Lincoln county	22	12.5	83
Ogallala, Keith county	17	14.3	78
Sidney, Cheyenne county			
Kimball, Kimball county	25	14.2	82
Alliance, Box Butte county			
Thedford, Thomas county	17	12	76.9
Broken Bow, Custer county	14	12.9	86
Ravenna, Buffalo county	19	14.2	89
	19	13.7	82.3

*Net, after cleaning and topping.

During the seven months of April to October, inclusive, 12.32 inches of rain fell in this district as against 14.99 inches in a normal season. The distribution of this rainfall throughout the months, as well as the temperature, can be seen from the table.

At a great many points in this district quite severe frosts were reported during the month of May, and the season in general was backward. A general expression for the season in this district, during the growing months, would be hot and dry with occasional hailstorms, which in many instances badly injured the growing beets.

Northern District.

The soil at the stations in the northern section does not vary materially from that of the middle and southern sections.

The season previous to planting—that is, the months of March and April—was much the same as for the other sections, except that the temperature was considerably lower, in fact April in the southern district was as warm as May in the northern. The rainfall for these two months was lower than the middle district and about the same as that of the southern district. Considerable snow fell in the northwestern part of the state during the month of April.

Seed was, as a rule, planted between the 20th and 30th of May at the sub-stations, though in some cases a second planting was necessary, which was not accomplished until the first of June. During the month of May there were several heavy frosts, and in general this month in the northwestern part of the state was considered unseasonably cold; for this reason, perhaps, seed did not germinate as readily as farther south. Time of germination varied from sixteen to forty days. A considerable portion did not germinate at all.

Table V, constructed from results obtained at sub-stations, and from Nebraska Weather Service, shows the conditions of the temperature and rainfall during the growing months.

TABLE V.

Meteorological Data for Summer of 1890 (Northern District).

Months.	Temperature, F.°		Rainfall (Inches).		Heat Units.
	1890.	Normal.	1890.	Normal.	
April	48.6	47.6	1.51	2.08	1458
May	55.2	56.2	1.92	3.19	1711
June	68.5	68	3.30	3.09	2055
July	75.2	74.1	3.11	2.43	2331
August	69.1	70.2	1.73	1.90	2142
September	60.7	60.4	0.20	0.84	1821
October	46.7	47.8	0.50	1.04	1447
Total	....	....	12.27	14.57	12965

Beets were analyzed from each of the stations in this district except Chadron Statements of average results are shown in Table VI.

TABLE VI.

Average of Results from Sub-stations (Northern District).

Sub-stations.	Weight—Ounces.*	Sucrose—Per Cent.	Purity.
Norfolk, Madison county	23	15.9	82
Neligh, Antelope county	20	14	81
O'Neill, Holt county	14	14.9	80
Long Pine, Brown county	9	9	68
Valentine, Cherry county	12	13.6	70
Chadron, Dawes county			
Crawford, Dawes county	21	15.5	75
	16.5	13.8	76

* Net, after cleaning and topping.

It will be seen that the season in this district does not vary far from the normal, except in the earlier months, and then the difference was chiefly in the rainfall. From April to October, inclusive, 12.27 inches of rain fell as against 14.57 during an average season.

The fact should not be lost sight of, that though each of these districts included portions of the state having great variations in both temperature and rainfall, the variations of rainfall here recorded cannot show as wide a variance from the normal as actually existed over wide areas. As has been stated, the determining feature in outlining these districts was their ease of accessibility by rail, rather than their condition of climate.

By bringing together the average results obtained at the sub-stations in each district we have in compact form a statement of what these stations have accomplished over the whole state during the first year of their establishment.

TABLE VII.

Statement of Averages from the Different Districts.

Districts.	Weight—Ounces.	Sucrose—Per Cent.	Purity.
Southern	15.8	14.4	75.8
Middle	19	18.7	82.8
Northern	16.5	18.8	76
Average for whole state	17.1	13.96	78

In the tables I, III, and V we have used the term "Heat units"* to bring into stronger view another comparison.

European beet culturists have brought out many interesting and valuable facts in regard to the meteorological conditions affecting the sugar yield there. While it would not be wise for us to accept as final, for our very different conditions of soil and climate, results and conclusions reached in Europe, yet it is the part of wisdom to follow the guide of European investigators and to learn by their experience.

Among other things, these men have found that it requires, for the full maturity of the beet, about 12,730° F. distributed through three months. In Germany, this heat is distributed through seven months as follows: April, 1,370; May, 1,840; June, 1,980; July, 2,140; August, 2,030; September, 1,840, and October, 1,530.†

Applying this method of computing amount of heat required for the development of the beet, the preceding tables show its distribution through the seven months of the past season, in the above mentioned districts.

The better to compare our climatological temperature factor with that of Europe, we have brought together in Table VII the average temperature of the whole state and that of Europe expressed in terms of "heat units."

TABLE VIII.

A comparison of the temperature of Nebraska (average of whole state), expressed in "heat units," with the temperature found by European investigators to be necessary for the production of sugar.

Months.	Nebraska.		Europe.
	1890.	Normal.	
April	1582	1182	1370
May	1811	1811	1840
June	2160	2112	1980
July	2433	2847	2140
August	2220	2186	2030
September	1908	1846	1840
October	1586	1556	1530
Total	13600	12990	12730

*The number of heat units in a month is the product of the daily average of temperature by the number of days in the month.

† Briem Journal des Fabricants de Sucre, October 23, 1878.

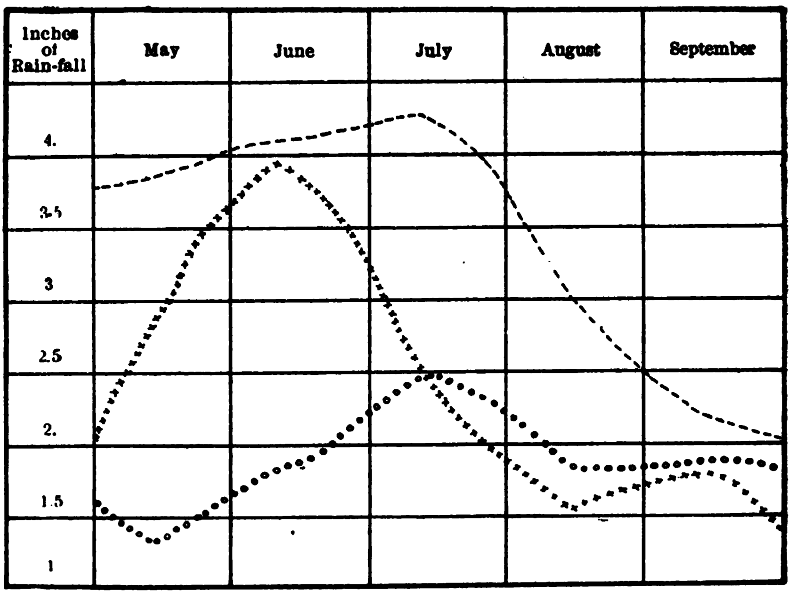
This shows the comparative high temperature of 1890 and also its distribution through the season.

This fact, taken in connection with the very good sugar content (Tables II, IV, VI), is an indication of much promise to the industry.

Again, the sum of the heat units during an average year in this state differs but little from the sum of the heat units required in Europe for sugar production, notwithstanding the fact that the months of June, July, and August are much warmer with us than there.

As a compensation for this excess of heat for these months we have a greater rainfall during these months than does the beet-growing region of Europe, as will be seen from the following rain chart of Nebraska and central Europe:

RAIN CHART OF NEBRASKA AND CENTRAL EUROPE.



NEBRASKA, - - - - - - - - - - -
CAMBRAI, FRANCE, ● ● ○ ○ ○ ○ ○ ○
HALLE, GERMANY, ✶✶✶✶✶✶✶✶✶

As was pointed out last year in Bulletin No. 13, it is not unlikely that this correlation of temperature and rainfall may prove a more important factor in the sugar problem than any other with which we have to deal.

BEETS FROM FARMERS THROUGHOUT THE STATE.

Seed, with instructions in regard to cultivation, was furnished all farmers applying for it, with the understanding that they should send samples of beets grown to the laboratory for analysis and that they would furnish information in regard to time of planting, kind of soil, amount and kind of cultivation, time of harvesting, yield, and cost.

The seasonal drawbacks early discouraged many, but a comparatively large number persevered to the end of the season.

Nearly five hundred samples of beets were received, representing all parts of the state. A map at the end of this pamphlet shows the distribution over the state of the beets analyzed during the season.

The following table gives the results of these analyses, with a condensed statement of such infoımation about the beets as it was possible to obtain.

TABLE IX.

The column headings are, with few exceptions, self-explanatory.

Season—The letters "T.," "R.," and "R. D." mean, respectively, temperature, rainfall, and rainy days.

Total Solids—This means the *entire* amount of solid matter, sugar and other substances, in 100 parts of the juice.

Sucrose—Under this head is recorded the entire amount of ordinary crystallizable sugar in 100 parts of the juice.

Glucose—Amount of non-crystallizable sugar in 100 parts of juice.

Purity—Percentage of sugar in the whole amount of solid matter in the juice.

TABLE IX.

Serial number.	GROWER.	POSTOFFICE ADDRESS.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil	Amount of Cultivation.
171	E. E. Nicholson	Lincoln, Lancaster county	Vilmorin	May 10	Sept. 15	Dark loam	Hoed.
172	C. C. Wright	Thedford, Thomas county					
173	A. Blood, Jr.	Crawford, Dawes county					
174	A. Blood, Jr.	Crawford, Dawes county					
175	A. Blood, Jr.	Crawford, Dawes county					
176	John R. Anderson	Oakland, Burt county	Vilmorin	June 18			
177	John R. Anderson	Oakland, Burt county	Imp. Wanzlebener	June 18			
178	John R. Anderson	Oakland, Burt county	Deprez				
179	John R. Anderson	Oakland, Burt county	Dippe's Improved				
180	R. B. Gregg	Marsland, Dawes county					
181	J. G. Smith	Lincoln, Lancaster county	Dippe's Wanzlebener	June 18	Oct. 4	Black loam	Hoed and cultivated.
182	J. G. Smith	Lincoln, Lancaster county	Dippe's Vilmorin	June 18	Oct. 4	Black loam	Hoed and cultivated.
183	J. G. Smith	Lincoln, Lancaster county	Improved Vilmorin	June 18	Oct. 4	Black loam	Hoed and cultivated.
184	J. G. Smith	Lincoln, Lancaster county	Lane's Imperial	June 18	Oct. 4	Black loam	Hoed and cultivated.
185	J. G. Smith	Lincoln, Lancaster county	White Sugar	June 18	Oct. 4	Black loam	Hoed and cultivated.
186	J. G. Smith	Lincoln, Lancaster county	Knauer	June 28	Oct. 4	Black loam	Hoed and cultivated.
187	J. G. Smith	Lincoln, Lancaster county	Vilmorin's Sugar	April 21	Oct. 4	Black loam	Hoed and cultivated.
188	J. G. Smith	Lincoln, Lancaster county	Deprez	May 10	Oct. 4	Black loam	Hoed and cultivated.
189	J. G. Smith	Lincoln, Lancaster county	Lemaire	May 10	Oct. 4	Black loam	Hoed and cultivated.
190	M. O'Conner	Erina, Garfield county	Lemaire	May 20	Sept. 26	Loam	Plowed and weeded.
191	M. O' onner	Erina, Garfield county	Deprez	May 20	Sept. 26	Loam	Plowed and weeded.
192	M. O'Conner	Erina, Garfield county	Wanzlebener	May 20	Sept. 26	Loam	Plowed and weeded.
193	J. M. Huet	McCook, Red Willow county	Dippe's Improved	May 15	Oct. 1		
194	J. M. Huet	McCook, Red Willow county	Deprez	May 15	Oct. 1		
195	J. M. Huet	McCook, Red Willow county	Dippe's Wanzlebener	May 15	Oct. 1		
196	J. M. Huet	McCook, Red Willow county	Improved Vilmorin	May 15	Oct. 1		
187	Frank Feninger	Orleans, Harlan county			Oct. 1	Sandy loam	
198	Frank Feninger	Orleans, Harlan county	Wanzlebener		Oct. 1	Sandy loam	
199	L. Woolworth	Orleans, Harlan county		May 28	Oct. 1	Sandy loam	
200	L. Woolworth	Orleans, Harlan county	Wanzlebener	May 28	Oct. 1	Sandy loam	
201	L Woolworth	Orleans, Harlan county	Wanzlebener	May 28	Oct. 1	Sandy loam	
202	—— Randolph	Holdrege, Phelps county					
203	—— Randolph	Holdrege, Phelps county					
204	—— Randolph	Holdrege, Phelps county					

TABLE IX—Continued.

Serial number.	Season. April. T.	April. R.	April. R. D.	May. T.	May. R.	May. R. D.	June. T.	June. R.	June. R. D.	July. T.	July. R.	July. R. D.	August. T.	August. R.	August. R. D.	September. T.	September. R.	September. R. D.	October. T.	October. R.	October. R. D.	November. T.	November. R.	November. R. D.	Weight of Beet. Pounds.	Weight of Beet. Ounces.	Total Solids.	Per Cent of Sugar. Sucrose.	Per Cent of Sugar. Glucose.	Purity.
171	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	4	......	12.4	0.240	......
172	......	....	......	......	......	......	78.4	2	9	82	0.73	5	75.3	2.02	6	62.2	0.00	0	50.8	0.27	1	38.2	0.40	1	2	7	......	12	0.260	......
173	*48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.9	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	1	8	......	10.5	0.260	......
174	48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	1	11	......	10	0.330	......
175	48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	1	9	......	10.5	0.160	......
176	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.59	6.1	39.4	0.63	2.9	1	5	......	9.5	0.116	......
177	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	5	......	12	0.165	......
178	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	8	......	10	0.200	......
179	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	2	6	......	10.5	0.188	......
180	48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	4.4	3.5	35.9	0.52	2.7	......	14	......	13.8	0.264	......
181	*54	0.32	1	......	3.43	8	68.9	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	12	15.2	3	0.175	19.7
182	54	0.32	1	......	3.43	8	68.9	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	......	13.5	3.5	0.169	25.9
183	54	0.32	1	......	3.43	8	68.9	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	58.7	1.12	6	41.7	0.61	3	......	10	13.5	3.5	0.195	25.9
184	54	0.32	1	......	3.43	8	68.9	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	1	11.3	5.5	0.180	48.6
185	54	0.32	1	......	3.43	8	68.9	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	14	12.2	7	0.142	57.3
186	54	0.32	1	......	3.43	8	68.9	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	14	14.7	5	0.109	34
187	54	0.32	1	......	3.43	8	68.9	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	13	13.7	6	0.236	43.7
188	54	0.32	1	......	3.43	8	68.9	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	14	12.9	1	0.120	77.5
189	54	0.32	1	......	3.43	8	68.9	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	5	13.1	6	0.161	45.8
190	*50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	15	14.5	5.5	0.165	37.2
191	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	1	......	14.8	4	0.185	27
192	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	12	14.5	10	0.181	68.9
193	50.3	2.7	5.2	61	1.25	0.5	67.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	3.8	2	39.4	0.76	2	......	7	16	10	0.214	62.2
194	50.3	2.7	5.2	61	1.25	0.5	67.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	3.8	2	39.4	0.76	2	......	10	15.6	6	0.136	38.4
195	50.3	2.7	5.2	61	1.25	0.5	67.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	3.8	2	39.4	0.76	2	......	11	15.6	7	0.167	44.8
196	50.3	2.7	5.2	61	1.25	0.5	67.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	3.8	2	39.4	0.76	2	......	10	13.8	7.5	0.274	54.3
197	50.3	2.7	5.2	61	1.25	0.5	67.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	3.8	2	39.4	0.77	2	......	5	10.7	7	0.171	65.4
198	50.3	2.7	5.2	61	1.25	0.5	67.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	92.9	0.48	1.9	52.2	3.8	2	39.4	0.76	2	......	4	13.3	5.5	0.143	41.3
199	50.3	2.7	5.2	61	1.25	0.5	67.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	92.9	0.48	1.9	52.2	3.8	2	39.4	0.76	2	......	14	14.7	9.3	0.164	63.2
200	50.3	2.7	5.2	61	1.25	0.5	67.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	3.8	2	39.4	0.76	2	......	12	15	7.5	0.223	50
201	50.3	2.7	5.2	61	1.25	0.5	67.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	3.8	2	39.4	0.76	2	......	12	15.3	8.8	0.174	24.8
202	......	......	......	......	......	......	74	1.71	10	80	0.75	2	74.7	1.00	6	......	0.45	2	......	0.40	1	......	1	2	......	8	14.5	10.8	0.193	74.4
203	......	......	......	......	......	......	74	1.71	10	80	0.75	2	74.7	1.00	6	......	0.45	2	......	0.40	1	......	1	2	......	8	15.7	10.8	0.094	68.7
204	......	......	......	......	......	......	74	1.71	10	80	0.75	2	74.7	1.00	6	......	0.45	2	......	0.40	1	......	1	2	......	11	14.8	10	0.183	67.5

*Average in section.

TABLE IX—CONTINUED.

Serial number.	GROWER.	POSTOFFICE ADDRESS.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
205	Commanding officer	Fort Niobrara, Cherry county				Sandy loam	
206	Commanding officer	Fort Niobrara, Cherry county				Sandy loam	
207	Commanding officer	Fort Niobrara, Cherry connty				Sandy loam	
208	A. B. Beard	Kimball, Kimball county					
209	A. B. Beard	Kimball, Kimball county					
210	Lewis Caryell	Kimball, Kimball county	Klein Wanzlebener	May 4	Oct. 7	Dark loam	Hoed.
211	Lewis Caryell	Kimball, Kimball county	Klein Wanzlebener	May 4	Oct. 7	Dark loam	Hoed.
212	Lewis Caryell	Kimball, Kimball county	Klein Wanzlebener	May 4	Oct. 7	Dark loam	Hoed.
213	C. E. Ward	Belvidere, Thayer county	Lemaire				
214	C. E. Ward	Belvidere, Thayer county	Desprez				
215	C. E. Ward	Belvidere, Thayer county	Desprez				
216	C. E. Ward	Belvidere, Thayer county	Klein Wanzlebener				
217	H. Montgomery	Precept, Furnas county	Vilmorin	May 5	Oct. 7	Sandy loam	Cultiv'd once a week until July 15.
218	H. Montgomery	Precept, Furnas county	Klein Wanzlebener	May 6	Oct. 7	Sandy loam	Cultiv'd once a week until July 15.
219	H. Montgomery	Precept, Furnas county	Desprez	May 6	Oct. 7	Sandy loam	Cultiv'd once a week until July 15.
220	H. Montgomery	Precept, Furnas county	Vilmorin	May 5	Oct. 7	Sandy loam	Cultiv'd once a week until July 15.
221	R. B. Gregg	Marsland, Dawes county	No. 2				
222	R. B. Gregg	Marsland, Dawes county					
223	J. M. Nesbitt	Ives, Dundy county	Improved White	May 15	Oct. 3	Sandy loam	Irrigated and hoed once.
224	J. M. Nesbitt	Ives, Dundy county	Improved White	May 15	Oct. 3	Sandy loam	
225	C. C. Hawkins	Wellfleet, Lincoln county	New Variety	May 15	Oct. 2	Sandy loam	Hoed twice.
226	C. C. Hawkins	Wellfleet, Lincoln county	Vilmorin	May 15	Oct. 2	Sandy loam	Hoed twice.
227	G. H. Purrington	Grant, Perkins county					
228	Stephen Bolles	McCook, Red Willow county	No. 1	April 23	Oct. 6	Sandy loam	Cultivated same as corn.
229	G. R. Street	Broken Bow, Custer county		June 4	Oct. 3	Sandy loam	Cultivated same as corn.
230	G. R. Street	Broken Bow, Custer county		June 4	Oct. 3	Sandy loam	Cultivated same as corn.
231	Joseph Kolar	Ravenna, Buffalo county					
232	Joseph Kolar	Ravenna, Buffalo county					
233	Joseph Kolar	Ravenna, Buffalo county					
234	Hugh Curran	Greeley Center, Greeley county					
235	Hugh Currrn	Greeley Center, Greeley county					
236	Hugh Curran	Greeley Center, Greeley county					
237	Hugh Curran	Greeley Center, Greeley county					
237a	E. E. Nicholson	Lincoln, Lancaster county	Desprez	May 10	Oct. 15	Dark loam	Hoed.

TABLE IX—Continued.

Serial number.	Season.																								Weight of Beet.		Total Solid.	Per Cent of Sugar.		Purity.
	April.			May.			June.			July.			August.			September.			October.			November.			Pounds.	Ounces.		Sucrose.	Glucose.	
	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.						
205	45.9	1	4	56	2.43	7	66	3	7	72.1	3.25	4	66.7	1.45	5	57.6	0.15	1	44.9	0.60	3	35.4	0.50	1	3	4	15.2	8	0.238	52.6
206	45.9	1	4	56	2.43	7	66	3	7	72.1	3.25	4	66.7	1.45	5	57.6	0.15	1	44.9	0.60	3	35.4	0.50	1	4	14	10.4	8	0.140	76.9
207	45.9	1	4	56	2.43	7	66	3	7	72.1	3.25	4	66.7	1.45	5	57.6	0.15	1	44.9	0.60	3	35.4	0.50	1	3	5	10.3	5	0.115	48.5
208	48.4	2.49	7	56	0.87	5	67.9	0.75	3	76.4	1.80	5	70.4	2.05	5	61.4	......	......	48.2	0.56	1	38.2	......	2	2	8	17.7	13.5	0.181	76.2
209	48.4	2.49	7	56	0.87	5	67.9	0.75	3	76.4	1.80	5	70.4	2.05	5	61.4	......	......	48.2	0.56	1	38.2	......	2	2	2	17.6	10	0.148	51.1
210	48.4	2.49	7	56	0.87	5	67.9	0.75	3	76.4	1.80	5	70.4	2.05	5	61.4	......	......	48.2	0.56	1	38.2	......	2	....	15	16.9	15	0.127	88.7
211	48.4	2.49	7	56	0.87	5	67.9	0.75	3	76.4	1.80	5	70.4	2.05	5	61.4	......	......	48.2	0.56	1	38.2	......	2	1	4	21.1	7.5	0.221	85.5
212	48.4	2.49	7	56	0.87	5	67.9	0.75	3	76.4	1.80	5	70.4	2.05	5	61.4	......	......	48.2	0.56	1	38.2	......	2	1	....	22.2	12	0.177	54
213	*55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	6	20.6	12	0.134	58
214	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	....	15.4	12	0.148	78
215	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	....	10	16.8	13.5	0.228	80
216	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	1	16.7	10.5	0.183	63
217	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	6	14.5	12.7	0.159	88
218	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	2	14.9	12	0.169	81
219	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	....	16.8	13.5	0.205	80
220	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	5	17.2	12	0.160	70
221	*48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	1	8	16.0	9	0.173	56.2
222	48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	1	15	17.5	12	0.198	68.5
223	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	6	17.4	15	0.217	86
224	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	11	15.6	9	0.224	57.6
225	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	10	17.2	15	0.179	87.
226	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	11	19.2	12	0.247	62.5
227	....	4.26	5	......	1.18	3	......	4.61	6	......	......	......	......	4.05	8	......	0.05	1	......	0.41	4	......	0.40	1	1	1	20.2	14	0.212	69.8
228	*53.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	2	7	16.3	14.2	0.189	87.1
229	50.9	1.85	4.2	59	2.73	7.4	52.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	1	1	15.3	12.9	0.179	84
230	50.9	1.85	4.2	59	2.73	7.4	52.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	....	12	14.1	12	0.135	85
231	52.4	2.76	7	59	2.85	10	72	2.75	8	78.8	1.66	6	70.4	1.98	10	62.7	0.86	4	50.4	2.04	5	39.3	1.03	3	1	2	17.5	15	0.172	85
232	52.4	2.76	7	59	2.85	10	72	2.75	8	78.8	1.66	6	70.4	1.98	10	62.7	0.86	4	50.4	2.04	5	39.3	1.03	3	....	14	17.7	15	0.128	84
233	52.4	2.76	7	59	2.85	10	72	2.75	8	78.8	1.66	6	70.4	1.98	10	62.7	0.86	4	50.4	2.04	5	39.3	1.03	3	....	15	17.7	15.2	0.163	85
234	*50.9	1.85	4.2	59	2.73	7.4	52.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	1	2	16.9	14.2	0.184	84
235	50.9	1.85	4.2	59	2.73	7.4	52.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	1	....	16.7	12.2	0.187	73
236	50.9	1.85	4.2	59	2.73	7.4	52.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	1	7	17.9	13.9	0.160	77.6
237	50.9	1.85	4.2	59	2.73	7.4	52.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	....	11	18.7	9	0.158	65.6
237a	54	0.82	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.93	5	52.7	1.12	6	41.7	0.61	3	....	11	18.7	9	0.158	65.6

*Mean of section.

TABLE IX—CONTINUED.

Serial number.	GROWER.	POSTOFFICE ADDRESS.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
238	E. E. Nicholson	Lincoln, Lancaster county	Lemaire	May 10	Oct. 15	Dark loam	Hoed.
239	Rosa Bouton	Lincoln, Lancaster county	Desprez	May 10	Oct. 11	Sandy loam	Hoed.
240	Rosa Bouton	Lincoln, Lancaster county	Vilmorin	May 10	Oct. 11	Sandy loam	Hoed.
241	Rosa Bouton	Lincoln, Lancaster county	Dippe's Improved	May 10	Oct. 11	Sandy loam	Hoed.
242	Peter Byrne	Arden, Boone county	Improved Sugar	May 1	Oct. 8	Dark loam	Hoed.
243	Peter Byrne	Arden, Boone county	Improved Sugar	May 1	Oct. 8	Dark loam	Hoed.
244	E. H. Sorenson	Dannebrog, Howard county	....	May 15	Oct. 1	Dark loam	Hoed.
245	S. C. Smith	Beatrice, Gage county	....	....	....	....	....
246	A. C. Robbins	Stamford, Harlan county	No. 1	May 5	Oct. 14	Sandy loam	Cultivated.
247	A. C. Robbins	Stamford, Harlan county	No. 4	May 5	Oct. 14	Sandy loam	Cultivated.
248	A. C. Robbins	Stamford, Harlan county	No. 3	May 5	Oct. 14	Sandy loam	Cultivated.
249	A. C. Robbins	Stamford, Harlan county	No. 5	May 5	Oct. 14	Sandy loam	Cultivated.
250	A. C. Robbins	Stamford, Harlan county	No. 2	May 5	Oct. 14	Sandy loam	Cultivated.
251	Uriah Bruner	West Point, Cuming county	Florimond Desprez	May 15	Oct. 15	Sandy loam	Cultivated.
252	Uriah Bruner	West Point, Cuming county	Klein Wanzlebener	May 15	Oct. 15	Sandy loam	Cultivated.
253	Uriah Bruner	West Point, Cuming county	Klein Wanzlebener	May 15	Oct. 15	Sandy loam	Cultivated.
254	Burt Toft	Norfolk, Madison county	Klein Wanzlebener	May 5	Oct. 10	Sandy loam	Weeded.
255	Dr. F. Verges	Norfolk, Madison county	Klein Wanzlebener	May 5	Oct. 10	Sandy loam	Weeded.
256	Dr. F. Verges	Norfolk, Madison county	Klein Wanzlebener	May 5	Oct. 10	Sandy loam	Weeded.
257	H. J. Wagner	Norfolk, Madison county	Vilmorin	May 20	Oct. 7	Sandy loam	Weeded.
258	J. G. Smith	Lincoln, Lancaster county	Lane's Sugar	April 21	Oct. 18	Dark loam	Hoed.
259	J. G. Smith	Lincoln, Lancaster county	Dippe's Wanzlebener	June 18	Oct. 18	Dark loam	Hoed.
260	J. G. Smith	Lincoln, Lancaster county	Vilmorin	April 28	Oct. 18	Dark loam	Hoed.
261	J. G. Smith	Lincoln, Lancaster county	Knauer	May 10	Oct. 18	Dark loam	Hoed.
262	J. G. Smith	Lincoln, Lancaster county	Vilmorin	April 28	Oct. 18	Dark loam	Hoed.
263	J. G. Smith	Lincoln, Lancaster county	Vilmorin	April 28	Oct. 18	Dark loam	Hoed.
264	J. G. Smith	Lincoln, Lancaster county	Dippe's Vilmorin	June 18	Oct. 18	Dark loam	Hoed.
265	J. G. Smith	Lincoln, Lancaster county	Lane's Sugar	April 21	Oct. 18	Dark loam	Hoed.
266	J. G. Smith	Lincoln, Lancaster county	Vilmorin	April 28	Oct. 18	Dark loam	Hoed.
267	H. J. Wagner	Norfolk, Madison county	Desprez	May 20	Oct. 6	Black loam	Hoed.
268	T. J. Horter	Norfolk, Madison county	Wanzlebener	May 10	Oct. 13	Clay loam	....
269	T. J. Horter	Norfolk, Madison county	Wanzlebener	May 10	Oct. 13	Clay loam	....
270	C. D. Hammond	Norfolk, Madison county	Wanzlebener	May 1	Oct. 6	Sandy loam	....
271	C. E. Norris	Ravenna, Buffalo county	Dippe's	June 6	Oct. 9	Sandy loam	Hoed four times.

TABLE IX—Continued.

Serial number.	Season. April. T.	R.	R. D.	May. T.	R.	R. D.	June. T.	R.	R. D.	July. T.	R.	R. D.	August. T.	R.	R. D.	September. T.	R.	R. D.	October. T.	R.	R. D.	November. T.	R.	R. D.	Weight of Beet. Pounds.	Ounces.	Total Solids.	Per Cent of Sugar. Sucrose.	Glucose.	Purity.
238	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	52.7	1.12	6	41.7	0.61	3	....	6	13.5	6	0.155	44.4
239	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	52.7	1.12	6	41.7	0.61	3	....	13	14.2	11	0.122	78
240	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	52.7	1.12	6	41.7	0.61	3	....	12	15.4	13.2	0.166	85
241	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	52.7	1.12	6	41.7	0.61	3	....	14	15.6	11	0.152	70.5
242	*50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	....	10	....	15.5	0.165	....
243	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	....	10	....	15	0.251	....
244	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	1	4	19.5	16	0.150	82.7
245	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	1	3	15.5	11.2	0.192	72.2
246	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	4	13.6	10	0.190	73.5
247	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	7	12.5	8	0.189	64
248	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	8	12.2	9.5	0.219	77.8
249	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	8	11.8	8.9	0.174	75.4
250	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	2	11.5	8.9	0.188	77.4
251	......	0.70	1	......	6.75	12	......	8.95	10	......	1.25	6	......	2.50	11	......	1.15	6	......	2.76	4	......	1.31	2	1	14	14.2	9.9	0.189	63
252	......	0.70	1	......	6.75	12	......	8.95	10	......	1.25	6	......	2.50	11	......	1.15	6	......	2.76	4	......	1.31	2	1	4	16.8	13.1	0.207	78
253	......	0.70	1	......	6.75	12	......	8.95	10	......	1.25	6	......	2.50	11	......	1.15	6	......	2.76	4	......	1.31	2	....	13	17	14	0.150	82
254	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	2	2	14.7	10	0.201	68
255	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	13	15.4	11.5	0.199	74.6
256	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	12	18.4	13.1	0.203	71.1
257	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	....	19.4	15.9	0.168	82
258	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	15	15.1	9	0.212	59.6
259	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	4	11.5	8	0.185	69.5
260	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	....	15.6	11.5	0.153	73.7
261	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	8	15	10	0.128	66.6
262	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	6	16	11.5	0.158	71.8
263	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	8	16.8	12.9	0.103	76.8
264	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	8	16	13.8	0.101	85
265	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	11	13.6	11.4	0.208	84
266	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	10	13.9	8.5	0.295	61.1
267	54	0.32	1	......	3.48	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	5	15.2	9.6	0.119	63.1
268	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.8	1.39	6.1	39.4	0.63	2.9	1	4	17	9	0.149	52.9
269	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.8	1.39	6.1	39.4	0.63	2.9	....	15	18.8	15.5	0.063	84.7
270	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.8	1.89	6.1	39.4	0.63	2.9	1	14	17.6	12.9	0.208	73.3
271	52.4	2.76	7	59	2.85	10	72	2.75	8	78.8	6.66	6	70.4	1.98	10	62.7	0.86	4	50.4	2.04	5	89.3	1.03	3	1	6	16.6	12.9	0.226	77.7

*Mean of section.

TABLE IX—Continued.

Serial number.	Grower.	Postoffice Address.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
272	C. E. Norris	Ravenna, Buffalo county	Dippe's Wanzlebener	June 6	Oct. 9	Sandy loam	Hoed four times.
273	C. E. Norris	Ravenna, Buffalo county	Desprez	June 6	Oct. 9	Sandy loam	Hoed four times.
274	C. E. Norris	Ravenna, Buffalo county	Vilmorin	June 6	Oct. 9	Sandy loam	Hoed four times.
275	Rosa Bouton	Lincoln, Lancaster county	Desprez	May 10	Oct. 18	Garden loam	Well cultivated.
276	Rosa Bouton	Lincoln, Lancaster county	Vilmorin	May 10	Oct. 18	Garden loam	Well cultivated.
277	Rosa Bouton	Lincoln, Lancaster county	Dippe's Improved	May 10	Oct. 18	Garden loam	Well cultivated.
278	T. H. Marsland	Lincoln, Lancaster county	Desprez	May 10	Oct. 18	Garden loam	Well cultivated.
279	T. H. Marsland	Lincoln, Lancaster county	Dippe's Improved	May 20	Oct. 18	Black loam	Hoed.
280	T. H. Marsland	Lincoln, Lancaster county	Imp. Vilmorin	May 20	Oct. 18	Black loam	Hoed.
281	T. H. Marsland	Lincoln, Lancaster county	Dippe's Wanzlebener	May 20	Oct. 18	Black loam	Hoed.
282	W. B. Wilson	Hastings, Adams county	Lemaire	May 6	Oct. 20	Black loam	Hoed.
283	W. B. Wilson	Hastings, Adams county	Vilmorin	May 6	Oct. 20	Black loam	Hoed.
284	W. B. Wilson	Hastings, Adams county	Klein Wanzlebener.	May 6	Oct. 20	Black loam	Hoed.
285	A. N. Morris	O'Neill, Holt county	Dippe's Improved				
286	A. N. Morris	O'Neill, Holt county	Desprez				
287	A. N. Morris	O'Neill, Holt county	Lemaire				
288	A. N. Morris	O'Neill, Holt county	Vilmorin				
289	A. N. Morris	O'Neill, Holt county	Wanzlebener				
290	H. Montgomery	Precept, Furnas county	Wanzlebener			Table land	
291	H. Montgomery	Precept, Furnas county	Vilmorin			Table land	
292	H. Montgomery	Precept, Furnas county	Florimond Desprez			Low land	
293	H. Montgomery	Precept, Furnas county	Florimond Desprez			Low land	
294	Josiah Alley	Endicott, Jefferson county	Desprez	April 15	Oct. 10	Sandy loam	Cultivated.
295	Josiah Alley	Endicott, Jefferson county	Desprez			Sandy loam	Cultivated.
296	Isaac Fisk	Fairbury, Jefferson county	Desprez	May 15	Oct. 10	Sandy loam	Cultivated.
297	Josiah Alley	Endicott, Jefferson county	Lemaire	April 15	Oct. 10	Sandy loam	Cultivated.
298	J. O. Boggs	Endicott, Jefferson county	No. 1	May 15	Oct. 10	Sandy loam	Cultivated.
299	W. W. Watson	Fairbury, Jefferson county					
300	Hon. R. W. Furnas	Brownville, Nemaha county	Klein Wanzlebener	May 13	Nov. 10	Prairie	Same as corn.
301	Hon. R. W. Furnas	Brownville, Nemaha county	Lane's Imperial	May 13	Nov. 10	Prairie	Same as corn.
302	Hon. R. W. Furnas	Brownville, Nemaha county	Lemaire	May 13	Nov. 10	Prairie	Same as corn.
303	Hon. R. W. Furnas	Brownville, Nemaha county	Desprez	May 13	Nov. 10	Prairie	Same as corn.
304	Hon. R. W. Furnas	Brownville, Nemaha county	Vilmorin	May 13	Nov. 10	Prairie	Same as corn.
305	R. B. Gregg	Marsland, Dawes county	Dippe's Wanzlebener	May 19	Oct. 20	Sandy loam	Hoed.

TABLE IX—Continued.

Serial number.	Season.																								Weight of Beet.		Total Solids.	Per Cent of Sugar.		Purity.
	April.			May.			June.			July.			August.			September.			October.			November.								
	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	Pounds.	Ounces.		Sucrose.	Glucose.	
272	52.4	2.76	7	59	2.85	10	72	2.75	8	78.8	1.66	6	70.4	1.98	10	62.7	0.86	4	50.4	2.04	5	39.3	1.03	3	1	......	16	13	0.132	81.2
273	52.4	2.76	7	59	2.85	10	72	2.75	8	78.8	1.66	6	70.4	1.98	10	62.7	0.8	4	50.4	2.04	5	39.3	1.03	3	1	......	15.9	12.3	0.253	77.3
274	52.4	2.76	7	59	2.85	10	72	2.75	8	78.8	1.66	6	70.4	1.98	10	62.7	0.86	4	50.4	2.04	5	39.3	1.03	3	1	11	17.6	13.8	0.124	78.9
275	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	11	16.7	14.7	0.114	88
276	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	9	16.1	12.5	0.162	77.6
277	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	9	16.1	13.7	0.175	85
278	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	14	16.1	13.8	0.147	85.7
279	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	4	14.2	12.7	0.205	89.4
280	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	11	14.8	12	0.228	81.1
281	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	11	15.3	12.8	0.218	83.6
282	......	......	......	......	......	......	......	......	......	......	......	......	......	2.36	8	......	0.50	2	......	0.75	2	......	1.75	3	......	9	17.5	14.2	0.139	81
283	......	......	......	......	......	......	......	......	......	......	......	......	......	2.36	8	......	0.50	2	......	0.75	2	......	1.75	3	1	6	21	17.3	0.276	82
284	......	......	......	......	......	......	......	......	......	......	......	......	......	2.36	8	......	0.50	2	......	0.75	2	......	1.75	3	......	12	17.6	13.3	0.210	75
285	......	......	......	......	......	......	......	3.28	10	77.2	2.37	9	70	3.17	10	62.9	0.11	3	51	0.68	4	40.9	0.35	1	......	15	19.8	14.4	0.166	72.7
286	......	......	......	......	......	......	......	3.28	10	77.2	2.37	9	70	3.17	10	62.9	0.11	3	51	0.68	4	40.9	0.35	1	1	1	18.4	13	0.119	70.6
287	......	......	......	......	......	......	......	3.28	10	77.2	2.37	9	70	3.17	10	62.9	0.11	3	51	0.68	4	40.9	0.35	1	......	12	17.8	13.5	0.138	76
288	......	......	......	......	......	......	......	3.28	10	77.2	2.37	9	70	3.17	10	62.9	0.11	3	51	0.68	4	40.9	0.35	1	......	10	20.9	15.5	0.211	74.1
289	......	......	......	......	......	......	......	3.28	10	77.2	2.37	9	70	3.17	10	62.9	0.11	3	51	0.68	4	40.9	0.35	1	1	1	19.5	14.6	0.168	74.8
290	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	1	19.5	16.1	0.143	83
291	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	......	4	19.5	15	0.109	76
292	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	......	5	18.4	13.5	0.085	74
293	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	......	8	18.4	12.9	0.199	71
294	......	1.55	4	......	2.01	9	......	3.16	8	......	6.98	9	......	2.78	9	......	1.82	3	......	1.85	4	......	1.12	2	......	11	17.5	11.5	0.172	65.7
295	......	1.55	4	......	2.01	9	......	3.16	8	......	6.98	9	......	2.78	9	......	1.82	3	......	1.85	4	......	1.12	2	......	13	15.8	11.9	0.250	75.9
296	......	1.55	4	......	2.01	9	......	3.16	8	......	6.98	9	......	2.78	9	......	1.82	3	......	1.85	4	......	1.12	2	1	7	16.8	13.5	0.229	82.8
297	......	1.55	4	......	2.01	9	......	3.16	8	......	6.98	9	......	2.78	9	......	1.82	3	......	1.85	4	......	1.12	2	......	12	16.8	13	0.173	77.3
298	......	1.55	4	......	2.01	9	......	3.16	8	......	6.98	9	......	2.78	9	......	1.82	3	......	1.85	4	......	1.12	2	......	13	14.5	10.1	0.150	69.7
299	......	1.55	4	......	2.01	9	......	3.16	8	......	6.98	9	......	2.78	9	......	1.82	3	......	1.85	4	......	1.12	2	2	4	15	10.1	0.168	67.3
300	*55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	13	14.4	10	0.476	63.4
301	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	11	14	10.4	0.200	74.2
302	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	2	......	14.8	10.5	0.166	70.9
303	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	12	15	12.5	0.119	80
304	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	12	13.8	10.9	0.188	78.9
305	*48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	1	4	20.2	14.9	0.211	78.7

* Mean for section.

TABLE IX—CONTINUED.

Serial number.	GROWER.	POSTOFFICE ADDRESS.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
306	R. B. Gregg	Marsland, Dawes county	Florimond Desprez	May 19	Oct. 20	Sandy loam	Hoed.
307	R. B. Gregg	Marsland, Dawes county	Florimond Desprez	May 19	Oct. 20	Sandy loam	Hoed.
308	Thos. Blasko	Ravenna, Buffalo county		May 5	Oct. 20	Black loam	Hand cultivated.
309	Thos. Blasko	Ravenna, Buffalo county		May 5	Oct. 20	Black loam	Hand cultivated.
310	J. N. Mills	Neligh, Antelope county	No. I				
311	J. N. Mills	Neligh, Antelope county	No. II				
312	C. H. Rogers	Springview, Keya Paha county	Lemaire				
313	C. H. Rogers	Springview, Keya Paha county	Klein Wanzlebener				
314	C. H. Rogers	Springview, Keya Paha county	Desprez				
315	J. P. Anderson	Oakland, Burt county	Ameliore Desprez				
316	J. P. Anderson	Oakland, Burt county	Ameliore Vilmorin				
317	J. P. Anderson	Oakland, Burt county	Dippe's Wanzlebener				
318	J. P. Anderson	Oakland, Burt county	Improved Vilmorin				
319	J. F. Blaine	Geneva, Fillmore county	Lemaire	May 11	Oct. 21	Black loam	Cultivated.
320	J. F. Blaine	Geneva, Fillmore county	Desprez	May 11	Oct. 21	Black loam	Cultivated.
321	J. F. Blaine	Geneva, Fillmore county	Wanzlebener	May 11	Oct. 21	Black loam	Cultivated.
322	S. P. Baker	Curtis, Frontier county					
323	J. Norwood	Curtis, Frontier county	Wanzlebener				
324	J. S. Shaw	Bancroft, Cuming county	Wanzlebener				
325	J. S. Shaw	Bancroft, Cuming county	Desprez				
326	J. S. Shaw	Bancroft, Cuming county	Dippe's Wanzlebener				
327	J. S. Shaw	Bancroft, Cuming county	Dippe's Vilmorin				
328	George Ward	Bancroft, Cuming county					
329	M. A. Senter	Bancroft, Cuming county					
330	M. A. Senter	Bancroft, Cuming county					
331	A. J. Pettit	S. E. corner Hayes county			Sept. 15	Sandy loam	Weeded.
332	A. J. Pettit	S. E. corner Hayes county			Sept. 15	Sandy loam	Weeded.
333	Wilhelm Kemper	Crete, Saline county	Improved Vilmorin		Sept. 15	Sandy loam	
334	Wilhelm Kemper	Crete, Saline county	Improved Vilmorin	May 20	Oct. 25	Prairie	Well cultivated.
335	T. H. Marsland	Lincoln, Lancaster county	Improved Vilmorin	May 20	Oct. 25	Prairie	Well cultivated.
336	T. H. Marsland	Lincoln, Lancaster county	Desprez	May 20	Oct. 25	Black loam	Cultivated, hoed, and weeded.
337	T. H. Marsland	Lincoln, Lancaster county	Dippe's Wanzlebener	May 20	Oct. 25	Black loam	Cultivated, hoed, and weeded.
338	T. H. Marsland	Lincoln, Lancaster county	Dippe's Improved	May 20	Oct. 25	Black loam	Cultivated, hoed, and weeded.
339	F. I. Foss	Crete, Saline county					

TABLE IX—CONTINUED.

Serial number.	Season. April. T.	April. R.	April. R. D.	May. T.	May. R.	May. R. D.	June. T.	June. R.	June. R. D.	July. T.	July. R.	July. R. D.	August. T.	August. R.	August. R. D.	September. T.	September. R.	September. R. D.	October. T.	October. R.	October. R. D.	November. T.	November. R.	November. R. D.	Weight of Beet. Pounds.	Weight of Beet. Ounces.	Total Solids.	Per Cent of Sugar. Sucrose.	Per Cent of Sugar. Glucose.	Purity.
306	*48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	....	6	20	13.7	0.168	68.5
307	48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	....	11	19.4	12.6	0.143	64.7
308	52.4	2.76	7	59	2.88	10	72	2.75	8	78.8	1.66	6	70.4	1.98	10	62.7	0.86	4	50.4	2.04	5	39.3	1.03	3	1	14	15.4	12	0.109	77.8
309	52.4	2.76	7	59	2.88	10	72	2.75	8	78.8	1.66	6	70.4	1.98	10	62.7	0.86	4	50.4	2.04	5	39.3	1.03	3	....	10	15.9	12.8	0.085	80.5
310	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	10	14.8	13	0.199	87.8
311	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	14	17.4	12.8	0.172	74.5
312	48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	....	13	19	15	0.250	78
313	48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	1	....	23	18	0.229	78
314	48.6	1.51	7.8	54.9	2.05	9.7	68.9	3.27	7.8	75.4	3.06	7	69.2	1.74	9.9	60.8	0.17	1.7	46.9	0.44	3.5	35.9	0.52	2.7	....	14	19.8	14	0.173	71
315	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	11	18	12.5	0.150	63.8
316	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	7	17.5	12.1	0.168	69.1
317	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	1	16.6	11.2	0.176	67.4
318	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	....	18.1	12.7	0.129	70.8
319	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.1	3	....	2.2	3	....	1.5	2	1	5	18	13.5	0.081	75
320	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.1	3	....	2.2	3	....	1.5	2	1	....	18	12.7	0.116	70
321	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0.1	3	....	2.2	3	....	1.5	2	....	11	18.5	13.5	0.169	73
322	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	3	15.3	10.5	0.115	64.7
323	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	2	....	15.8	10.2	0.094	64.5
324	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	11	16	11	0.128	68.7
325	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	1	19	10	0.132	68.4
326	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	8	20	14.1	0.130	75
327	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	11	19.8	15.5	0.126	78.2
328	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	2	2	15.6	10.7	0.082	68.6
329	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	13	16.7	11.9	0.075	71.2
330	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.2	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	14	17.6	14	0.107	79.5
331	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	7	20.5	15	0.109	73.1
332	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	11	22.8	17	0.190	75
333	53.5	1.31	7	59.4	3.46	11	74	4.48	9	78.6	2.47	7	71.1	2.93	7	62.2	1.14	6	51	1.64	6	40.2	1.42	3	....	11	19.3	15	0.080	77.7
334	53.5	1.31	7	59.4	3.46	11	74	4.48	9	78.6	2.47	7	71.1	2.93	7	62.2	1.14	6	51	1.64	6	40.2	1.42	3	....	10	17.8	13.6	0.115	76.4
335	54	0.32	1	....	3.43	8	....	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	12	16.1	11	0.108	68.3
336	54	0.32	1	....	3.43	8	....	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	12	15.7	12.8	0.119	81.5
337	54	0.32	1	....	3.43	8	....	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	13	14.1	11	0.119	78
338	54	0.32	1	....	3.43	8	....	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	1	15.9	12.1	0.105	76.1
339	53.5	1.31	7	59.4	3.46	11	74	4.48	9	78.6	2.47	7	71.1	2.93	7	62.2	1.14	6	51	1.64	6	40.2	1.42	3	1	6	14.2	9.1	0.070	64.1

* Mean of section.

TABLE IX—Continued.

Serial number.	Grower.	Postoffice Address.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
340	C. F. Burge	Ashland, Saunders county					
341	C. F. Burge	Ashland, Saunders county					
342	S. S. Weddell	Ashland, Saunders county	Lemaire	May 26	Oct. 15	Prairie	Cultivated three times.
343	S. S. Weddell	Ashland, Saunders county	Lemaire	May 26	Oct. 15	Prairie	Cultivated three times.
344	S. S. Weddell	Ashland, Saunders county	Lemaire	May 26	Oct. 15	Prairie	Cultivated three times.
345	S. S. Weddell	Ashland, Saunders county	Lemaire	May 26	Oct. 15	Prairie	Cultivated three times.
346	F. A. Frost	Stanton, Stanton county	Knauer	June 6	Oct. 30	Upland	Hoed twice.
347	F. A. Frost	Stanton, Stanton county	Knauer	June 6	Oct. 30	Upland	
348	J. M. Michell	Stanton, Stanton county		June 10	Oct. 30	Lowland	
349	J. M. Michell	Stanton, Stanton county		June 10	Oct. 30	Lowland	
350	B. F. Isaman	Aurora, Hamilton county	Desprez	May 18	Oct. 24	Black loam	Sub-soiled and plowed.
351	B. F. Isaman	Aurora, Hamilton county	Desprez	May 18	Oct. 24	Black loam	Sub-soiled and plowed.
352	J. M. Henssen	Grand Island, Hall county	Klein Wanzlebener.	April 10	Oct. 20	Sandy loam	Well cultivated.
353	J. M. Henssen	Grand Island, Hall county	Klein Wanzlebener.	April 10	Oct. 20	Sandy loam	Well cultivated.
354	W. M. Lakin	Aurora, Hamilton county				Black loam	Well cultivated.
355	W. M. Lakin	Aurora, Hamilton county				Black loam	Well cultivated.
356	G. W. Fairfield	Minotaur, Scott's Bluff county	Desprez	May 15	Oct. 10	Rich loam	Cultivated.
357	G. W. Fairfield	Minotaur, Scott's Bluff county	Wanzlebener	May 15	Oct. 10	Rich loam	Cultivated.
358	G. W. Fairfield	Minotaur, Scott's Bluff county	Lemaire	May 15	Oct. 25	Rich loam	Cultivated.
359	G. W. Fairfield	Minotaur, Scott's Bluff county	Lane's Improve			Rich loam	Cultivated.
360	S. C. Smith	Beatrice, Gage county					
361	S. C. Smith	Beatrice, Gage county					
362	O. Netsell	Stromsburg, Polk county					
363	O. Netsell	Stromsburg, Polk county					
364	O. Netsell	Stromsburg, Polk county					
365	O. Netsell	Stromsburg, Polk county					
366	O. Netsell	Stromsburg, Polk county					
367	J. T. Ryan	Ogalalla, Keith county	Klein Wanzlebener.	May 24	Oct. 23	Sandy loam	Cultivated.
368	J. T. Ryan	Ogalalla, Keith county	Klein Wanzlebener.	May 24	Oct. 23	Sandy loam	Cultivated.
369	Cary Depriest	Ogalalla, Keith county				Sandy loam	Cultivated.
370	Cary Depriest	Ogalalla, Keith county				Sandy loam	
371	George Paden	Ogalalla, Keith county				Sandy loam	
372	George Paden	Ogalalla, Keith county				Sandy loam	
373	G. A. Hummer	David City, Butler county		May 17	Oct. 29	Black loam	Hoed and plowed.

TABLE IX—CONTINUED.

Serial number.	Season. April. T.	April. R.	April. R. D.	May. T.	May. R.	May. R. D.	June. T.	June. R.	June. R. D.	July. T.	July. R.	July. R. D.	August. T.	August. R.	August. R. D.	September. T.	September. R.	September. R. D.	October. T.	October. R.	October. R. D.	November. T.	November. R.	November. R. D.	Weight of Beet. Pounds.	Weight of Beet. Ounces.	Total Solids.	Per Cent of Sugar. Sucrose.	Per Cent of Sugar. Glucose.	Purity.
340	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	......	14	16.1	11.7	0.194	72.7
311	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	......	13	19	12.9	0.229	67.9
342	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	......	8	18.8	13.5	0.144	71.8
343	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.48	2	......	4	......	14	0.122	......
344	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	......	7	18.4	14.7	0.148	80
345	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	......	9	17.9	14.5	0.176	81
346	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	4	16.7	14	0.114	84
347	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	......	15	16.8	12.3	0.110	73.2
348	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	......	14	15.6	11.5	0.104	73.7
349	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	......	10	15.2	10	0.073	65.7
350	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.45	3.3	38.3	0.73	2.2	......	11	15.4	10	0.101	64.9
351	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	9	17	11.3	0.115	66.4
352	48.7	1.12	3	......	1.32	8	......	......	......	75.3	0.55	4	64.9	2.72	10	57.2	1.27	3	45.3	0.65	2	35.7	1.05	3	......	13	17.9	13.9	0.119	77.6
353	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	13	22	17	0.132	77.2
354	50.9	1.85	4.3	59	3.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2	......	12	18.7	18	0.120	69
355	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	11	16.4	18.7	0.129	83.5
356	47.6	3.19	11	55.3	1.95	11	68.4	0.62	3	77.4	1.75	6	70.6	1.41	9	63	1	......	49	0.16	2	40.2	0.56	0.3	1	2	16.7	13.6	0.124	82
357	47.6	3.19	11	55.3	1.95	11	68.4	0.62	3	77.4	1.75	6	70.6	1.41	9	63	1	......	49	0.16	2	40.2	0.56	0.3	......	14	19	15	0.109	80
358	47.6	3.19	11	55.3	1.95	11	68.4	0.62	3	77.4	1.75	6	70.6	1.41	9	63	1	......	49	0.16	2	40.2	0.56	0.3	......	11	18.6	14.6	0.156	78
359	47.6	3.19	11	55.3	1.95	11	68.4	0.62	3	77.4	1.75	6	70.6	1.41	9	63	1	......	49	0.16	2	40.2	0.56	0.3	......	11	17.5	14.7	0.108	84
360	*55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	4	18.6	13	0.152	70
361	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	2	16.8	11	0.163	65.4
362	*55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	......	16.8	13	0.126	77.3
363	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	13	17.8	13.8	0.184	77.5
361	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	10	16.8	13	0.092	71.4
365	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	1	17.3	13	0.104	75.1
366	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	2	16.7	13	0.077	77.8
367	*48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	11	18.2	13	0.076	71.4
368	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	......	12	16.6	11.6	0.101	69.8
369	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	7	21.3	16	0.126	75.1
370	*48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	11	18.1	18	0.129	71.2
371	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	......	15	17	14.3	0.110	85
372	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	......	8	12.5	10	0.121	80
373	......	1.05	4	......	1.13	5	......	5.25	8	71	2.20	4	62.4	2.49	8	......	1.25	3	......	0.85	3	......	1.45	2	......	18	16.1	12	0.130	74.5

*Mean of section.

TABLE IX—CONTINUED.

Serial number.	GROWER.	POSTOFFICE ADDRESS.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil	Amount of Cultivation.
374	G. A. Hummer	David City, Butler county		May 17	Oct. 29	Black loam	Hoed and plowed.
375	G. A. Hummer	David City, Butler county		May 17	Oct. 29	Black loam	Hoed and plowed.
376	B. Henberg	North Platte, Lincoln county					
377	Jno. Neary	North Platte, Lincoln county					
378	B. Hershey	North Platte, Lincoln county					
379	B. Hershey	North Platte, Lincoln county					
380	B. Hershey	North Platte, Lincoln county				Sandy loam	Hoed.
381	Isaiah Alley	Endicott, Jefferson county				Sandy loam	Hoed.
382	Isaiah Alley	Endicott, Jefferson county				Sandy loam	Hoed.
383	Isaiah Alley	Endicott, Jefferson county				Sandy loam	
384	Paul Frenan	Grand Island, Hall county				Sandy loam	
385	Paul Frenan	Grand Island, Hall county				Sandy loam	
386	Paul Frenan	Grand Island, Hall county				Sandy loam	
387		McCook, Red Willow county	No. 1	June 15	Oct. 27	Bottom land	Cultivated.
388		McCook, Red Willow county	No. 2	June 15	Oct. 27	Bottom land	Cultivated.
389		McCook, Red Willow county	No. 3	June 15	Oct. 27	Bottom land	Cultivated.
390	E. E. Nicholson	Lincoln, Lancaster county	Klein Wanzlebener				
391	E. E. Nicholson	Lincoln, Lancaster county	Lemaire				
392	E. E. Nicholson	Lincoln, Lancaster county	Desprez				
393	E. E. Nicholson	Lincoln, Lancaster county	Klein Wanzlebener				
394	S. F. Martin	Atlantic, Iowa	German Sugar			Black loam	Cultivated by hand.
395	S. F. Martin	Atlantic, Iowa	German Sugar			Black loam	Cultivated by hand.
396	S. F. Martin	Atlantic, Iowa	German Sugar			Black loam	Cultivated by hand.
397	Wm. Coleman	McCook, Red Willow county	No. 1				
398	Wm. Coleman	McCook, Red Willow county	No. 2				
399	Wm. Coleman	McCook, Red Willow county	No. 3				
400	R. Van Meter	Elsie, Perkins county	No. 1	May 23	Oct. 31	Sandy loam	
401	R. Van Meter	Elsie, Perkins county	No. 2	May 23	Oct. 31	Sandy loam	
402	R. Van Meter	Elsie, Perkins county	No. 3	May 23	Oct. 31	Sandy loam	
403	R. Van Meter	Elsie, Perkins county	No. 4	May 23	Oct. 31	Sandy loam	
404	R. Van Meter	Elsie, Perkins county	No. 5	May 23	Oct. 31	Sandy loam	
405	E. Bannister	Venango, Perkins county		May 15	Oct. 20	Sandy loam	Cultivated.
406	L. A. Ganson	Lodge Pole, Cheyenne county	No. 2	April 16	Oct. 31	Dark loam	Cultivated four times.
407	L. A. Ganson	Lodge Pole, Cheyenne county	No. 1	April 16	Oct. 31	Dark loam	Cultivated four times.

TABLE IX—Continued.

Serial number.	Season.																								Weight of Beet.		Total Solids.	Per Cent of Sugar.		Purity.
	April.			May.			June.			July.			August.			September.			October.			November.								
	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	Pounds.	Ounces.		Sucrose.	Glucose.	
374	....	1.05	4	......	1.13	5	......	5.25	8	71	2.20	4	62.4	2.49	8	......	1.25	3	......	0.85	3	......	1.45	2	....	13	16.6	14	0.126	84.3
375	....	1.05	4	......	1.13	5	......	5.25	8	71	2.20	4	62.4	2.49	8	......	1.25	3	......	0.85	3	......	1.45	2	....	10	18.1	14.9	0.177	82.3
376	50	4.46	12	58	0.90	9	70	2.96	9	74	3.9	8	71	2.42	10	65	1.9	3	51	0.84	4	39	0.42	1	1	....	16.1	14	0.188	87
377	50	4.46	12	58	0.90	9	70	2.06	7	74	0.39	8	71	2.42	10	63	1.9	3	51	0.84	4	39	0.42	1	1	10	19	14	0.140	73.6
378	50	4.46	12	58	0.90	9	70	2.06	7	74	0.39	8	71	2.42	10	63	1.9	3	51	0.84	4	39	0.42	1	1	11	15.4	12.2	0.189	79.2
379	50	4.46	12	58	0.90	9	70	2.06	7	74	0.39	8	71	2.42	10	63	1.9	3	51	0.84	4	39	0.42	1	1	9	15.1	13	0.187	86
380	50	4.46	12	58	0.90	9	70	2.06	7	74	0.39	8	71	2.42	10	63	1.9	3	51	0.84	4	39	0.42	1	1	....	14.8	11	0.103	74.3
381	*55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	2	....	16.3	12	0.116	73
382	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	....	14	18.6	13	0.158	70
383	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	....	14	19.6	16	0.144	82
384	48.7	1.12	3	......	1.32	8	......	......	......	75.3	0.55	4	64.9	2.72	10	57.2	1.27	3	45.3	0.65	2.	35.7	1.05	3	....	15	16.4	14	0.157	85
385	48.7	1.12	3	......	1.32	8	......	......	......	75.3	0.55	4	64.9	2.72	10	57.2	1.27	3	45.3	0.65	2	35.7	1.05	3	....	14	18.4	14	0.125	76
386	48.7	1.12	3	......	1.32	8	......	......	......	75.3	0.55	4	64.9	2.72	10	57.2	1.27	3	45.3	0.65	2	35.7	1.05	3	....	10	18.1	15	0.105	82.8
387	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	9	16.2	12	0.117	73
388	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	5	16.2	11	0.125	67.9
389	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	10	21.2	19.2	0.114	85
390	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	11	17.7	15.5	0.138	87
391	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	12	17.9	13.2	0.136	73.7
392	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	1	16.1	11.4	0.124	70.8
393	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	4	16.1	14	0.159	86.9
394	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	14	20.2	14.6	0.102	72.2
395	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	5	15.3	11	0.072	71.8
396	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	....	15.2	10	0.084	65.8
397	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	12	15.2	10	0.129	65.8
398	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	9	17.4	12	0.148	69
399	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	11	20	13.5	0.066	67.5
400	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	5	24.1	18	0.084	75
401	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	12	25.5	21	0.070	82
402	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	8	25.6	21.8	0.068	83
403	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	8	23.9	20	0.179	84
404	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	12	23	20.6	0.103	89
405	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	8	25.1	20	0.091	79.6
406	*48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	14	23.9	17	0.105	71.1
407	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	14	21.4	15	0.131	70

* Average for section.

TABLE IX—CONTINUED.

Serial number.	Grower.	Postoffice Address.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
408	J. P. Anderson	Oakland, Burt county	Ameliore Desprez				
409	J. P. Anderson	Oakland, Burt county	Ameliore Vilmorin				
410	J. P. Anderson	Oakland, Burt county	Dippe's Wanzlebener				
411	Geo. A. Curry	Kirkwood, Rock county	No. 2	May 26	Nov. 1	Sandy loam	Horse cultivator.
412	Geo. A. Curry	Kirkwood, Rock county	Desprez	May 26	Nov. 1	Sandy loam	Horse cultivator.
413	Geo. A. Curry	Kirkwood, Rock county	Desprez	May 26	Nov. 1	Sandy loam	Horse cultivator.
414	Geo. A. Curry	Kirkwood, Rock county	Lemaire	May 26	Nov. 1	Sandy loam	Horse cultivator.
415	Geo. A. Curry	Kirkwood, Rock county	Lemaire	May 26	Nov. 1	Sandy loam	Horse cultivator.
416	Geo. A. Curry	Kirkwood, Rock county	Klein Wanzlebener	May 26	Nov. 1	Sandy loam	Horse cultivator.
417	Geo. A. Curry	Kirkwood, Rock county	Klein Wanzlebener	May 26	Nov. 1	Sandy loam	Horse cultivator.
418	J. C. Wolfe	Lodge Pole, Cheyenne county		June 15	Oct. 20	Creek bottom	
419	J. C. Wolfe	Lodge Pole, Cheyenne county		June 15	Oct. 20	Creek bottom	
420	J. Ward	Elwood, Gosper county	Klein Wanzlebener		Nov. 1		
421	J. Ward	Elwood, Gosper county	Desprez		Nov. 1		
422	J. Ward	Elwood, Gosper county	Lemaire		Nov. 1		
423	J. W. Hawkins	Minden, Kearney county	No. 1	May 10	Oct. 1	Black loam	Cultivated and hoed.
424	J. W. Hawkins	Minden, Kearney county	No. 2	May 10	Oct. 1	Black loam	Cultivated and hoed.
425	J. W. Hawkins	Minden, Kearney county	No. 3	May 10	Oct. 1	Black loam	Cultivated and hoed.
426	J. W. Hawkins	Minden, Kearney county	No. 4	May 10	Oct. 1	Black loam	Cultivated and hoed.
427	L. Copeland	Minden, Kearney county	Improved Desprez				
428	L. Copeland	Minden, Kearney county	Improved Vilmorin				
429	L. Copeland	Minden, Kearney county	Imp. Wanzlebener				
430	L. Copeland	Minden, Kearney county	Dippe's Improved				
431	John Clause	Ericson, Wheeler county					
432	John Clause	Ericson, Wheeler county					
433	Wellington Arbertrum	Grant, Perkins county					
434	L. C. Vroman	Blanche, Chase county	Klein Wanzlebener	June 7	Oct. 21	Sandy loam	Cultivated twice.
435	Stephen Jacobs	Grant, Perkins county	No. 1				
436	Stephen Jacobs	Grant, Perkins county	No. 2				
437	George Jacobs	Grant, Perkins county					
438	L. G. Babcock	Neligh, Antelope county	No. 1	May 10	Nov. 1	Black loam	Hoed and plowed.
439	L. G. Babcock	Neligh, Antelope county	No. 2	May 10	Nov. 1	Black loam	Hoed and plowed.
440	L. G. Babcock	Neligh, Antelope county	No. 3	May 10	Nov. 1	Black loam	Hoed and plowed.
441	Edward McIntyre	Seward, Seward county	Lemaire	April 20	Nov. 15	Dark loam	Hoed five times.

TABLE IX—Continued.

Serial number.	Season. April. T.	April. R.	April. R. D.	May. T.	May. R.	May. R. D.	June. T.	June. R.	June. R. D.	July. T.	July. R.	July. R. D.	August. T.	August. R.	August. R. D.	September. T.	September. R.	September. R. D.	October. T.	October. R.	October. R. D.	November. T.	November. R.	November. R. D.	Weight of Beet. Pounds.	Weight of Beet. Ounces.	Total Solids.	Per Cent of Sugar. Sucrose.	Per Cent of Sugar. Glucose.	Purity.
408	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	4	18	13	0.252	72.2
409	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	13	16.9	11	0.192	65
410	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	2	17.7	12	0.103	67.8
411	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	4	17.7	13.5	0.194	76
412	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	12	19	15.3	0.197	80
413	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	12	18.9	14.1	0.101	75
414	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	4	18.9	16	0.120	85
415	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	9	21.2	16	0.135	75
416	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	8	21.2	17	0.070	80
417	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	....	15	22.6	20	0.114	88
418	*48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	9	21.3	18.9	0.066	88.3
419	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	11	19.2	15	0.077	78.1
420	......	......	......	......	......	......	78.6	4.54	8	86	1	4	76.2	2.5	4	......	......	......	......	......	......	......	......	......	....	9	21.2	16	0.104	75.4
421	......	......	......	......	......	......	78.6	4.54	8	86	1	4	76.2	2.5	4	......	......	......	......	......	......	......	......	......	....	10	21.4	18	0.068	81.1
422	......	......	......	......	......	......	78.6	4.51	8	86	1	4	76.2	2.5	4	......	......	......	......	......	......	......	......	......	....	9	19.9	16	0.085	80.4
423	52.9	2.11	5	61.2	2.36	10	73.3	4.55	11	80.2	1.45	7	72.1	1.33	6	64	1.3	4	51.3	0.3	2	37.8	1.3	4	....	12	19.8	15	0.072	75.7
424	52.9	2.11	5	61.2	2.36	10	73.3	4.55	11	80.2	1.45	7	72.1	1.33	6	64	1.3	4	51.3	0.3	2	37.8	1.3	4	....	11	20.3	15.3	0.227	75.3
425	52.9	2.11	5	61.2	2.36	10	73.3	4.55	11	80.2	1.45	7	72.1	1.33	6	64	1.3	4	51.3	0.3	2	37.8	1.3	4	....	12	19.9	16	0.086	80.4
426	52.9	2.11	5	61.2	2.36	10	73.3	4.55	11	80.2	1.45	7	72.1	1.33	6	64	1.3	4	51.3	0.3	2	37.8	1.3	4	....	9	20.8	16	0.078	76.8
427	52.9	2.11	5	61.2	2.36	10	73.3	4.55	11	80.2	1.45	7	72.1	1.33	6	64	1.3	4	51.3	0.3	2	37.8	1.3	4	1	6	17	12.6	0.127	74.1
428	52.9	2.11	5	61.2	2.36	10	73.3	4.55	11	80.2	1.45	7	72.1	1.33	6	64	1.3	4	51.3	0.3	2	37.8	1.3	4	1	4	18.3	13.1	0.101	71.6
429	52.9	2.11	5	61.2	2.36	10	73.3	4.55	11	80.2	1.45	7	72.1	1.33	6	64	1.3	4	51.3	0.3	2	37.8	1.3	4	1	8	18.6	13	0.127	70
430	52.9	2.11	5	61.2	2.36	10	73.3	4.55	11	80.2	1.45	7	72.1	1.33	6	64	1.3	4	51.3	0.3	2	37.8	1.3	4	1	5	19.6	14.5	0.101	74
431	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	63.3	2.28	2	50.3	2.18	4	38.5	0.35	2	....	9	18.2	13	0.142	71.4
432	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	63.3	2.28	2	50.3	2.18	4	38.5	0.35	2	....	12	17.3	13	0.082	80
433	......	4.26	5	......	1.18	3	......	4.61	6	......	......	......	......	4.05	3	......	0.05	1	......	0.41	4	......	0.4	1	....	12	18.8	15.5	0.123	82.4
434	......	4.26	5	......	1.18	3	......	4.61	6	......	......	......	......	4.05	3	......	0.05	1	......	0.41	4	......	0.4	1	1	8	16.2	12	0.070	74
435	......	4.26	5	......	1.18	3	......	4.61	6	......	......	......	......	4.05	3	......	0.05	1	......	0.41	4	......	0.40	1	1	7	14.8	10	0.089	67.5
436	......	4.26	5	......	1.18	3	......	4.61	6	......	......	......	......	4.05	3	......	0.05	1	......	0.41	4	......	0.40	1	1	11	16.4	10	0.109	60
437	......	4.26	5	......	1.18	3	......	4.61	6	......	......	......	......	4.05	3	......	0.05	1	......	0.41	4	......	0.40	1	1	....	20.1	14	0.101	66.6
438	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	5	17.2	13	0.125	81.3
439	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	2	17.7	15	0.070	85
440	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	7	18.1	14	0.047	77.1
441	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	1.01	4	52.8	0.71	4	46.2	1.40	3	....	11	18.6	12	0.107	64.5

*Mean of section.

TABLE IX—CONTINUED.

Serial number.	Grower.	Postoffice Address.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
442	Edward McIntyre	Seward, Seward county	Desprez	April 20	Nov. 15	Dark loam	Hoed five times.
443	Edward McIntyre	Seward, Seward county	Desprez	April 20	Nov. 15	Dark loam	Hoed five times.
444	Hon. R. W. Furnas	Brownville, Nemaha county	Klein Wanzlebener	May 13	Nov. 10	Prairie	Same as corn.
445	Hon. R. W. Furnas	Brownville, Nemaha county	Vilmorin	May 13	Nov. 10	Prairie	Same as corn.
446	Hon. R. W. Furnas	Brownville, Nemaha county	Imperial	May 13	Nov. 10	Prairie	Same as corn.
447	Hon. R. W. Furnas	Brownville, Nemaha county	Lemaire	May 13	Nov. 10	Prairie	Same as corn.
448	Hon. R. W. Furnas	Brownville, Nemaha county	Desprez	May 13	Nov. 10	Prairie	Same as corn.
449	J. J. Lowe	Thedford, Thomas county	Knauer	June 6	Nov. 1	Sandy loam	No cultivation.
450	J. J. Lowe	Thedford, Thomas county	Knauer	June 6	Nov. 1	Sandy loam	No cultivation.
451	Strong Peppa	Elwood, Gosper county		May 15	Nov. 3	Sandy loam	Hoed and plowed.
452	A. R. Keim	Falls City, Richardson county	No. 3	May 15	Nov. 4	Rich loam	Plowed.
453	A. R. Keim	Falls City, Richardson county	No. 3	May 15	Nov. 4	Rich loam	Plowed.
454	Dr. A. S. Mansfelde	Ashland, Saunders county	Klein Wanzlebener		Nov. 6	Sandy loam	
455	Dr. A. S. Mansfelde	Ashland, Saunders county	Desprez		Nov. 6	Sandy loam	
456	Dr. A. S. Mansfelde	Ashland, Saunders county	Lemaire		Nov. 6	Sandy loam	
457	Geo. S. Freeman	Genoa, Nance county	No. 1		Nov. 1		
458	Geo. S. Freeman	Genoa, Nance county	No. 2		Nov. 1		
459	Geo. S. Freeman	Genoa, Nance county	No. 3		Nov. 1		
460	Geo. S. Freeman	Genoa, Nance county	No. 4		Nov. 1		
461	Geo. S. Freeman	Genoa, Nance county	No. 5		Nov. 1		
462	Uriah Bruner	West Point, Cuming county	Klein Wanzlebener	May 15	Nov. 1	Rich loam	No fertilizers.
463	Edgar G. Bruner	Swan, Holt county	Klein Wanzlebener	May 20	Oct. 14	Sandy loam	No fertilizers.
464	S. Miles	West Point, Cuming county	Desprez	June 1	Oct. 20	Sandy loam	
465	D. Brown	Blair, Washington county					
466	P. A. Jones	Blair, Washington county					
467	S. D. Hudleson	Blair, Washington county					
468	John Smith	Blair, Washington county					
469	Jacob Short	Blair, Washington county					
470	C. M. Nelson	Overton, Dawson county	No. 5	May 17	Nov. 5	Sandy loam	Cultivated twice.
471	C. M. Nelson	Overton, Dawson county	No. 1	May 17	Nov. 5	Sandy loam	Cultivated twice.
472	C. M. Nelson	Overton, Dawson county	No. 2	May 17	Nov. 5	Sandy loam	Cultivated twice.
473	C. M. Nelson	Overton, Dawson county	No. 3	May 17	Nov. 5	Sandy loam	Cultivated twice.
474	C. M. Nelson	Overton, Dawson county	Sugar	May 17	Nov. 5	Sandy loam	Cultivated twice.
475	C. M. Nelson	Overton, Dawson county	No. 4	May 17	Nov. 5	Sandy loam	Cultivated twice.

TABLE IX—Continued.

Serial number.	Season.																								Weight of Beet.		Total Solid.	Per Cent of Sugar.		Purity.
	April.			May.			June.			July.			August.			September.			October.			November.								
	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	Pounds.	Ounces.		Sucrose.	Glucose.	
442	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	13	20.4	13	0.064	63.7
443	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	1	......	17.6	13	0.080	73.8
444	*55.2	1.08	3.90	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	......	17.9	12	0.112	67
445	55.2	1.08	3.90	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	12	17.4	13	0.063	80
446	55.2	1.08	3.90	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	12	18.5	13.1	0.142	70.8
447	55.2	1.08	3.90	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	4	16.1	12	0.101	74.5
448	55.2	1.08	3.90	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	8	16.3	12	0.114	73.6
449	......	......	......	......	......	......	78.4	2	9	82	0.73	5	75.3	2.02	6	63.3	3	3	60.8	0.27	1	38.2	0.40	1	......	6	15.6	12	0.087	76.9
450	......	......	......	......	......	......	78.4	2	9	82	0.73	5	75.3	2.02	6	63.3	3	3	60.8	0.27	1	38.2	0.40	1	......	8	14.9	11	0.104	73.8
451	......	......	......	......	......	......	78.6	4.54	8	86	1	4	76.2	2.5	4	......	......	......	......	......	......	......	......	......	1	5	16.2	11	0.104	67.9
452	55.2	1.08	3.90	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	......	16.5	12	0.130	72.7
453	55.2	1.08	3.90	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	13	16.2	11	0.167	67.9
454	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	1	7	12.7	9.9	0.112	77.9
455	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	1	7	11.4	15	0.078	86
456	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	1	4	14.5	11	0.191	75.8
457	52.2	1.31	4	59.7	3.40	11	72.9	4.38	11	78.7	1.51	6	71.5	2.66	10	63.8	3.84	4	50.5	1.23	3	39.8	1.07	2	......	11	15.9	11	0.155	69.1
458	52.2	1.31	4	59.7	3.40	11	72.9	4.38	11	78.7	1.51	6	71.5	2.66	10	63.8	3.84	4	50.5	1.23	3	39.8	1.07	2	......	9	16.7	13.7	0.054	82
459	52.2	1.31	4	59.7	3.40	11	72.9	4.38	11	78.7	1.51	6	71.5	2.66	10	63.8	3.84	4	50.5	1.23	3	39.8	1.07	2	......	10	19.9	16.9	0.121	84.9
460	52.2	1.31	4	59.7	3.40	11	72.9	4.38	11	78.7	1.51	6	71.5	2.66	10	63.8	3.84	4	50.5	1.23	3	39.8	1.07	2	......	6	16.7	13.9	0.170	83.2
461	52.2	1.31	4	59.7	3.40	11	72.9	4.38	11	78.7	1.51	6	71.5	2.66	10	63.8	3.84	4	50.5	1.23	3	39.8	1.07	2	......	10	17.2	13.5	0.054	78.4
462	......	0.70	1	......	6.75	12	......	8.95	10	......	1.25	6	......	2.50	11	......	1.15	6	......	2.76	4	......	1.31	2	......	8	15.2	11.5	0.080	76
463	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	......	10	19.8	15	0.047	75.7
464	......	0.70	1	......	6.75	12	......	8.95	10	......	1.25	6	......	2.5	11	......	1.15	6	......	2.76	4	......	1.31	2	1	......	18	12.6	0.047	70
465	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	3	19.5	16.4	0.101	84
466	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	......	12	17.4	13.8	0.116	79.3
467	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	4	18.3	15	0.086	81.9
468	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	......	16.9	13.9	0.079	82.2
469	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	......	9	18.7	15	0.056	80.2
470	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	12	17.7	14.4	0.057	81.1
471	*50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	15	19	14	0.075	74.1
472	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	11	19.5	15.8	0.051	81
473	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	9	18.7	14.1	0.066	76
474	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	12	18.8	16	0.045	85
475	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	12	17.4	13.5	0.092	79

*Mean of section.

TABLE IX—Continued.

Serial number.	Grower.	Postoffice Address.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
476	C. M. Nelson	Overton, Dawson county	Desprez	May 17	Nov. 5	Sandy loam	Cultivated twice.
477	Commanding Officer	Fort Niobrara, Cherry county					
478	A. H. Gale	Bassett, Rock county	Klein Wanzlebener	May 20	Oct. 20	Sandy loam	Hoed twice.
479	A. H. Gale	Bassett, Rock county	Klein Wanzlebener	May 20	Oct. 30	Sandy loam	Hoed twice.
480	A. H. Gale	Bassett, Rock county	Klein Wanzlebener	May 20	Oct. 20	Sandy loam	Hoed twice.
481	Carl Zelneck	Long Pine, Brown county	Sugar	June 1	Oct. 30	Sandy loam	
482	Carl Zelneck	Long Pine, Brown county	Sugar	June 1	Oct. 30	Sandy loam	
483	Carl Zelneck	Long Pine, Brown county	Sugar	June 1	Oct. 30	Sandy loam	
484	Carl Zelneck	Long Pine, Brown county	Sugar	June 1	Oct. 30	Sandy loam	
485	L. C. Vroman	Blanche, Chase county	Klein Wanzlebener				
486	L. C. Vroman	Blanche, Chase county	Desprez				
487	W. B. Earl	Chambers, Holt county		May 27	Oct. 31	Sandy loam	Hoed twice.
488	W. B. Earl	Chambers, Holt county		May 27	Oct. 31	Sandy loam	Hoed twice.
489	W. B. Earl	Chambers, Holt county		May 27	Oct. 31	Sandy loam	Hoed twice.
490	W. B. Earl	Chambers, Holt county		May 27	Oct. 31	Sandy loam	Hoed twice.
491	D. M. Fulmer	Gibbon, Buffalo county	Dippe's Improved	May 15	Nov. 1	Loam	Hoed once a week.
492	D. M. Fulmer	Gibbon, Buffalo county	Vilmorin	May 15	Nov. 1	Loam	Hoed once a week.
493	D. M. Fulmer	Gibbon, Buffalo county	Desprez	May 15	Nov. 1	Loam	Hoed once a week.
494	D. M. Fulmer	Gibbon, Buffalo county	Wanzlebener	May 15	Nov. 1	Loam	Hoed once a week.
495	J. A. Zimmerman	Beatrice, Gage county	Desprez				
496	J. A. Zimmerman	Beatrice, Gage county	Desprez				
497	J. A. Zimmerman	Beatrice, Gage county	Desprez				
498	J. Rimmer	Beatrice, Gage county	Desprez				
499	J. Rimmer	Beatrice, Gage county	Desprez				
500	Wm. Andrew	Beatrice, Gage county	Imperial White				
501	Wm. Andrew	Beatrice, Gage county	Imperial White				
502	Philip Gascoine	Beatrice, Gage county	Imperial White				
503	Philip Gascoine	Beatrice, Gage county	Imperial White				
504	Philip Gascoine	Beatrice, Gage county	Imperial White				
505	Philip Gascoine	Beatrice, Gage county	Imperial White				
506	J. G. Smith	Lincoln, Lancaster county	White Sugar				
507	J. G. Smith	Lincoln, Lancaster county	Lane's Sugar				
508	J. G. Smith	Lincoln, Lancaster county	Dippe's Improved				
509	J. G. Smith	Lincoln, Lancaster county	Improved Vilmorin				

TABLE IX—CONTINUED.

Serial number.	Season. April. T.	April. R.	April. R. D.	May. T.	May. R.	May. R. D.	June. T.	June. R.	June. R. D.	July. T.	July. R.	July. R. D.	August. T.	August. R.	August. R. D.	September. T.	September. R.	September. R. D.	October. T.	October. R.	October. R. D.	November. T.	November. R.	November. R. D.	Weight of Beet. Pounds.	Weight of Beet. Ounces.	Total Solids.	Per Cent of Sugar. Sucrose.	Per Cent of Sugar. Glucose.	Purity.
476	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	15	16.2	12	0.047	74
477	45.9	1	4	50.6	2.43	7	66	3	7	72.1	3.25	4	66.7	1.45	5	57.6	0.15	1	44.9	0.60	3	35.4	0.50	1	1	11	16.7	12	0.034	71.8
478	......	......	......	57.8	1.50	......	71.2	3.10	10	76.1	2.76	2	69.2	2.10	9	62.8	0.23	2	......	0.41	2	34	0.85	......	......	12	16.7	13	0.128	78
479	......	......	......	57.8	1.50	......	71.2	3.10	10	76.1	2.76	2	69.2	2.10	9	62.8	0.23	2	......	0.41	2	34	0.85	......	......	8	18.6	15	0.060	81
480	......	......	......	57.8	1.50	......	71.2	3.10	10	76.1	2.76	2	69.2	2.10	9	62.8	0.23	2	......	0.41	2	34	0.85	......	......	8	18.2	14.6	0.116	75
481	......	......	......	57.5	......	14	73.1	......	......	78.5	3.50	8	72.7	2.60	16	......	......	......	......	......	......	......	......	......	1	......	14.5	10	0.097	63.9
482	......	......	......	57.5	......	14	73.1	......	......	78.5	3.50	8	72.7	2.60	16	......	......	......	......	......	......	......	......	......	......	12	12.4	8.2	0.114	66.1
483	......	......	......	57.5	......	14	73.1	......	......	78.5	3.50	8	72.7	2.60	16	......	......	......	......	......	......	......	......	......	......	8	14.3	10	0.073	69.8
484	......	......	......	57.5	......	14	73.1	......	......	78.5	3.50	8	72.7	2.60	16	......	......	......	......	......	......	......	......	......	......	9	12.3	8	0.074	65
485	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	2	2	17.6	12	0.029	68.1
486	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	10	16.9	11	0.064	65
487	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	......	8	16.3	12	0.052	74
488	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	......	8	15.1	13.5	0.050	89
489	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	9	18.5	15	0.077	81
490	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	1	19.8	16	0.021	81
491	*50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	12	19.6	16.1	0.029	82.1
492	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	11	18.7	14.2	0.025	75.9
493	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	2	......	16.3	11.5	0.022	70.5
494	50.9	1.85	4.2	59	2.73	7.4	72.2	3.04	8.2	78.5	0.97	4.4	70.9	2.41	9	62	1.33	3.3	49.1	1.48	3.3	38.3	0.73	2.2	......	12	17.4	14.2	0.061	81.6
495	*55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	9	17.9	14	0.038	78.2
496	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	10	15.4	12	0.066	77.9
497	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	9	14.9	12	0.068	80.5
498	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	7	16.1	13	0.021	80.7
499	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	5	21.6	19	0.028	88
500	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	6	16.6	12.4	0.035	74.6
501	*55.2	1.08	3.9	61.9	2.82	5.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	8	16.9	12.4	0.020	73.3
502	55.2	1.08	3.9	61.9	2.82	5.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	12	16.2	12	0.026	74
503	55.2	1.08	3.9	61.9	2.82	5.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	13	19.3	14	0.018	72.5
504	55.2	1.08	3.9	61.9	2.82	5.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	14	20.8	15	0.018	72.1
505	55.2	1.08	3.9	61.9	2.82	5.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	......	12	19.6	15	0.028	76.5
506	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	8	17.7	13	0.016	73.4
507	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	9	16.4	12	0.016	73.1
508	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	11	16.4	12.3	0.052	75
509	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	15	16.2	12.5	0.016	77.1

*Mean for section.

TABLE IX—CONTINUED.

Serial number.	GROWER.	POSTOFFICE ADDRESS.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
510	J. G. Smith	Lincoln, Lancaster county	Knauer				
511	J. G. Smith	Lincoln, Lancaster county	Desprez				
512	F. H. Preston	McCook, Red Willow county					
513	F. H. Preston	McCook, Red Willow county					
514	J. Stockdale	Ashland, Saunders county					
515	J. Stockdale	Ashland, Saunders county					
516	J. G Smith	Lincoln, Lancaster county	Dippe's Vilmorin				
517	J. G. Smith	Lincoln, Lancaster county	Improved Vilmorin				
518	J. G. Smith	Lincoln, Lancaster county	Dippe's Wanzlebener				
519	J. G. Smith	Lincoln, Lancaster county	White Sugar				
520	J. G. Smith	Lincoln, Lancaster county	Lane's Sugar				
521	J. G. Smith	Lincoln, Lancaster county	Vilmorin				
522	J. G. Smith	Lincoln, Lancaster county	Knauer				
523	J. G. Smith	Lincoln, Lancaster county	Knauer				
524	Peter McNitt	Red Cloud, Webster county	Klein Wanzlebener	June 1	Nov. 18	Sandy loam	No cultivation.
525	Peter McNitt	Red Cloud, Webster county	Klein Wanzlebener	June 1	Nov. 18	Sandy loam	No cultivation.
526	Peter McNitt	Red Cloud, Webster county	Klein Wanzlebener	June 1	Nov. 18	Sandy loam	No cultivation.
527	Peter McNitt	Red Cloud, Webster county	Klein Wanzlebener	June 1	Nov. 18	Sandy loam	No cultivation.
528	Peter McNitt	Red Cloud, Webster county	Klein Wanzlebener	June 1	Nov. 18	Sandy loam	No cultivation.
529	Peter McNitt	Red Cloud, Webster county	Klein Wanzlebener	June 1	Nov. 18	Sandy loam	No cultivation.
530	Jacob Wiebe	Beatrice, Gage county	Dippe's Vilmorin				
531	Jacob Wiebe	Beatrice, Gage county	Dippe's Vilmorin				
532	Jacob Wiebe	Beatrice, Gage county	Dippe's Vilmorin				
533	Chas. J. Grabbe	Crawford, Dawes county					
534	Chas. J. Grabbe	Crawford, Dawes county					
535	Chas. J. Grabbe	Crawford, Dawes county					
536	Jno. Kegeris	Madrid, Perkins county	No. 1	May 17	Nov. 22	Sandy	Garden cultivation.
537	Jno. Kegeris	Madrid, Perkins county	No. 2	May 17	Nov. 22	Sandy	Garden cultivation.
538	Jno. Kegeris	Madrid, Perkins county	No. 3	May 17	Nov. 22	Sandy	Garden cultivation.
539	Jno. Kegeris	Madrid, Perkins county	No. 4	May 17	Nov. 22	Sandy	Garden cultivation.
540	S. M. Hoyt	Papillion, Sarpy county					
541	S. M. Hoyt	Papillion, Sarpy county					
542	S. M. Hoyt	Papillion, Sarpy county					
543	Michel Beadle	Papillion, Sarpy county					

TABLE IX—Continued.

Serial number.	Season. April. T.	April. R.	April. R. D.	May. T.	May. R.	May. R. D.	June. T.	June. R.	June. R. D.	July. T.	July. R.	July. R. D.	August. T.	August. R.	August. R. D.	September. T.	September. R.	September. R. D.	October. T.	October. R.	October. R. D.	November. T.	November. R.	November. R. D.	Weight of Beet. Pounds.	Weight of Beet. Ounces.	Total Solids.	Per Cent of Sugar. Sucrose.	Per Cent of Sugar. Glucose.	Purity.
510	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	8	15.1	12.5	0.024	82.1
511	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	6	16.6	12.5	0.015	76.5
512	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	5	18.7	12	0.013	64.1
513	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	4	18	12	0.102	66.6
514	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	1	2	21.9	16	0.086	73
515	57.2	0.96	4	65	4.34	8	75.2	4.92	8	79.9	4.58	5	76.8	3.07	7	60.5	1.51	5	51.9	1.09	9	......	1.43	2	....	12	22.7	17	0.110	76
516	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.81	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	9	19.2	17	0.057	88.5
517	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.81	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	14	18.5	16	0.062	80
518	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.81	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	5	17.3	15.1	0.059	87.2
519	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.81	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	4	17.4	13	0.080	74.7
520	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.81	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	11	16.4	13	0.075	79.2
521	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.81	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	....	16.5	12.5	0.067	75.7
522	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.81	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	1	3	15.7	11.2	0.072	71.3
523	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.81	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	....	13	17.6	12.2	0.067	69.3
524	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	13	17.6	13.4	0.069	76.1
525	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	13	17.2	12.1	0.097	70.3
526	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	10	15.4	11	0.044	71.4
527	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	14	17	12	0.053	70.5
528	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	....	17.7	14.2	0.055	80.2
529	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	5	14.8	11	0.091	74.3
530	*55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	1	14.6	12.4	0.086	84.9
531	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	12	17.3	14	0.089	80.9
532	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	10	17.2	13.5	0.076	78.4
533	*51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	1	7	14.4	10	0.083	69.4
534	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	....	15	13	8.5	0.110	65.3
535	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	1	5	15.5	10	0.084	64.5
536	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	12	14.3	10	0.101	69.2
537	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	10	14.4	10	0.091	69.4
538	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	13	15.3	10.5	0.038	75.1
539	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	....	9	15	10.5	0.096	70
540	52.2	0.57	2	65	3.16	12	76	6.91	8	84	3.52	3	......	......	......	......	......	......	......	......	......	......	......	......	....	13	16	12	0.074	80.6
541	52.2	0.57	2	65	3.16	12	76	6.91	8	84	3.52	3	......	......	......	......	......	......	......	......	......	......	......	......	1	4	19	13.9	0.066	73.1
542	52.2	0.57	2	65	3.16	12	76	6.91	8	84	3.52	3	......	......	......	......	......	......	......	......	......	......	......	......	....	12	17.9	13	0.050	77.6
543	52.2	0.57	2	65	3.16	12	76	6.91	8	84	3.52	3	......	......	......	......	......	......	......	......	......	......	......	......	1	....	16.5	12.3	0.083	74.5

* Mean of section.

TABLE IX—CONTINUED.

Serial number.	GROWER.	POSTOFFICE ADDRESS.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
544	Michel Beadle	Papillion, Sarpy county					
545	Michel Beadle	Papillion, Sarpy county					
546	Michel Beadle	Papillion, Sarpy county					
547	Otis W. Hahn	Valentine, Cherry county					
548	Otis W. Hahn	Vatentine, Cherry county					
549	Chas. Smolenski	Valentine, Cherry county					
550	Chas. Smolenski	Valentine, Cherry county					
551	Chas. Smolenski	Valentine, Cherry county					
552	Chas. Smolenski	Valentine, Cherry county					
553	John Firstl	Valentine, Cherry county					
554	John Firstl	Valentine, Cherry county					
555	John Firstl	Valentine, Cherry county					
556	John Firstl	Valentine, Cherry county					
557	Strong Peppa	Elwood, Gosper county		May 15	Nov. 3	Sandy loam	Hoed.
558	Strong Peppa	Elwood, Gosper county		May 15	Nov. 3	Sandy loam	Hoed.
559	Rosa Bouton	Lincoln, Lancaster county	Vilmorin	May 15	Nov. 3	Sandy loam	Well cultivated.
560	Rosa Bouton	Lincoln, Lancaster county	Vilmorin	May 15	Nov. 3	Sandy loam	Well cultivated.
561	Rosa Bouton	Lincoln, Lancaster county	Vilmorin	May 15	Nov. 3	Sandy loam	Well cultivated.
562	Rosa Bouton	Lincoln, Lancaster county	Desprez	May 15	Nov. 3	Sandy loam	Well cultivated.
563	Elijah Allen	Omaha, Douglas county	Improved Vilmorin		Nov. 18	Loam	
564	Elijah Allen	Omaha, Douglas county	Improved Vilmorin		Nov. 18	Loam	
565	Elijah Allen	Omaha, Douglas county	Improved Vilmorin		Nov. 18	Loam	
566	Elijah Allen	Omaha, Douglas county	Dippe's Improved		Nov. 18	Loam	
567	Elijah Allen	Omaha, Douglas county	Dippe's Improved		Nov. 18	Loam	
568	A. H. Bemis	Seward, Seward county	Nonpareil	June 10	Nov. 20	Loam	
569	A. H. Bemis	Seward, Seward county	Nonpareil	June 10	Nov. 20	Loam	
570	A. H. Bemis	Seward, Seward county	Nonpareil	June 10	Nov. 20	Loam	
571	A. H. Bemis	Seward, Seward county	Nonpareil	June 10	Nov. 20	Loam	
572	C. R. Wadsworth	Harrison, Sioux county					
573	C. R. Wadsworth	Harrison, Sioux county					
574	C. R. Wadsworth	Harrison, Sioux county					
575	A. R. Kennedy	Harrison, Sioux county					
576	A. R. Kennedy	Harrison, Sioux county					
577	A. R. Kennedy	Harrison, Sioux county					
578	W. C. O'Conner	Harrison, Sioux county					
579	W. C. O'Conner	Harrison, Sioux county					

TABLE IX—CONTINUED.

Serial number.	Season. April. T.	April. R.	April. R. D.	May. T.	May. R.	May. R. D.	June. T.	June. R.	June. R. D.	July. T.	July. R.	July. R. D.	August. T.	August. R.	August. R. D.	September. T.	September. R.	September. R. D.	October. T.	October. R.	October. R. D.	November. T.	November. R.	November. R. D.	Weight of Beet. Pounds.	Weight of Beet. Ounces.	Total Solids.	Per Cent of Sugar. Sucrose.	Per Cent of Sugar. Glucose.	Purity.
544	52.2	0.57	2	65	3.16	12	76	6.91	8	84	3.52	3	......	......	......	......	......	......	......	......	......	......	......	......	2	1	17.2	13	0.057	75.4
545	52.2	0.57	2	65	3.16	12	76	6.91	8	84	3.52	3	......	......	......	......	......	......	......	......	......	......	......	......	1	14	16.6	11	0.048	75.3
546	52.2	0.57	2	65	3.16	12	76	6.91	8	84	3.52	3	......	......	......	......	......	......	......	......	......	......	......	......	1	12	16.6	11	0.141	75.3
547	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	......	14	18.2	13.5	0.094	74.1
548	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	......	12	21.6	16.1	0.123	74.5
549	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	......	9	19.2	13.5	0.063	69.2
550	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	......	13	17.6	12.4	0.010	70.4
551	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	1	......	17.9	13	0.119	72.6
552	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	......	8	17.5	13.2	0.057	75.4
553	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	......	6	15.9	11.4	0.038	71.6
554	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	......	7	17	12	0.109	70.5
555	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	......	5	16	13.2	0.074	82.5
556	56	1.33	5	55.2	1.91	10	68.8	3.09	......	76	4.39	11	69.3	2.04	12	62	0.68	4	49	0.64	5	38	0.93	5	1	11	15.6	12	0.086	76.9
557	......	......	......	......	......	......	78.6	4.54	8	86	1	4	76.2	2.50	4	......	......	......	......	......	......	......	......	......	......	15	16.1	13	0.089	80.7
558	......	......	......	......	......	......	78.6	4.54	8	86	1	4	76.2	2.50	4	......	......	......	......	......	......	......	......	......	......	8	17.2	14.3	0.041	83.1
559	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	8	14.6	11	0.105	75.8
560	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	7	15.7	11.3	0.040	71.9
561	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	9	16.7	11.7	0.050	70
562	54	0.32	1	......	3.43	8	......	3.14	5	79.6	1.72	4	71.4	1.84	10	63.3	0.98	5	53.7	1.12	6	41.7	0.61	3	......	12	17.8	13.2	0.090	74.1
563	55	1.55	6	60	2.72	12	74	5.04	12	78.8	3.74	8	70	1.02	11	62.1	2.50	7	52	1.09	9	42	1.01	3	......	14	17.2	15.4	0.108	89.5
564	55	1.55	6	60	2.72	12	74	5.04	12	78.8	3.74	8	70	1.02	11	62.1	2.50	7	52	1.09	9	42	1.01	3	......	12	18.5	16	0.078	80
565	55	1.55	6	60	2.72	12	74	5.04	12	78.8	3.74	8	70	1.02	11	62.1	2.50	7	52	1.09	9	42	1.01	3	......	9	16.8	15.1	0.043	89.8
566	55	1.55	6	60	2.72	12	74	5.04	12	78.8	3.74	8	70	1.02	11	62.1	2.50	7	52	1.09	9	42	1.01	3	......	7	17	13.5	0.080	79.4
567	55	1.55	6	60	2.72	12	74	5.04	12	78.8	3.74	8	70	1.02	11	62.1	2.50	7	52	1.09	9	42	1.01	3	......	15	16.9	13.2	0.057	78.1
568	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	1.01	4	52.8	0.71	4	46.2	1.40	3	......	8	22.1	16.4	0.242	74
569	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	1.01	4	52.8	0.71	4	46.2	1.40	3	......	5	17.5	15.1	0.211	86
570	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	1.01	4	52.8	0.71	4	46.2	1.40	3	......	11	15.6	12.1	0.123	78
571	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	1.01	4	52.8	0.71	4	46.2	1.40	3	......	13	17.2	11	0.154	64
572	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	......	12	16.6	12	0.179	72.8
573	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	1	13	19.6	15.1	0.117	77
574	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	......	13	18.4	15.1	0.125	82
575	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	1	3	18.9	15	0.039	79.8
576	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	1	4	20.7	15	0.088	72.4
577	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	......	12	19.8	12.3	0.166	62.1
578	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	......	12	25.4	20	0.050	78.7
579	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	......	9	31.5	23.2	0.223	73.6

TABLE IX—CONTINUED.

Serial number.	GROWER.	POSTOFFICE ADDRESS.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
580	W. C. O'Conner	Harrison, Sioux county					
581	Bigelow Bros.	Harrison, Sioux county					
582	Bigelow Bros.	Harrison, Sioux county					
583	Bigelow Bros.	Harrison, Sioux county					
584	Bigelow Bros.	Harrison, Sioux county					
585	Samuel Nail	Freeport, Banner county		May 20	Oct. 20	Sandy loam	Hoed twice.
586	Clark Krickbaum	Freeport, Banner county		May 28	Oct. 20	Black loam	Hoed twice.
587	Clark Krickbaum	Freeport, Banner county		May 28	Oct. 20	Black loam	Hoed twice.
588	Wm. Butcher	Freeport, Banner county		May 15	Oct. 12	Sandy loam	Hoed three times.
589	Geo. W. Buchong	Freeport, Banner county	Wanzlebener	May 15	Oct. 12	Sandy loam	Hoed three times.
590	Samuel Nail	Freeport, Banner county		May 20	Oct. 20	Sandy loam	Hoed twice.
591	O. A. Kirk	Freeport, Banner county		May 30	Oct. 20	Sandy loam	Hoed twice.
592	O. A. Kirk	Freeport, Banner county		May 30	Oct. 20	Sandy loam	Hoed twice.
593	Frank Hinzie	Freeport, Banner county		May 15	Oct. 18	Black loam	Hoed once.
594	Wm. Butcher	Freeport, Banner county		May 15	Oct. 15	Black loam	Hoed three times.
595	Wm. Butcher	Freeport, Banner county		May 15	Oct. 15	Black loam	Hoed three times.
596	W. R. Harmon	Freeport, Banner county		May 25	Nov. 12	Sandy loam	Hoed twice.
597	W. R. Harmon	Freeport, Banner county		May 25	Nov. 12	Sandy loam	Hoed twice.
598	W. R. Harmon	Freeport, Banner county					
599	T. H. Wilson	Freeport, Banner county	No. 1	May 15	Oct. 15	Sandy loam	Drilled and hoed.
600	T. H. Wilson	Freeport, Banner county	No. 2	May 15	Oct. 15	Sandy loam	Drilled and hoed.
601	T. H. Wilson	Freeport, Banner county	No. 3	May 15	Oct. 15	Sandy loam	Drilled and hoed.
602	T. H. Wilson	Freeport, Banner county	No. 4	May 15	Oct. 15	Sandy loam	Drilled and hoed.
603	T. H. Wilson	Freeport, Banner county	No. 5	May 15	Oct. 15	Sandy loam	Drilled and hoed.
604	T. H. Wilson	Freeport, Banner county		May 15	Oct. 15	Sandy loam	Drilled and hoed.
605	T. H. Wilson	Freeport, Banner county		May 15	Oct. 15	Sandy loam	Drilled and hoed.
606	Hon. R. W. Furnas	Brownville, Nemaha county	Vilmorin				Drilled and hoed.
607	Hon. R. W. Furnas	Brownville, Nemaha county	Wanzlebener				
608	Hon. R. W. Furnas	Brownville, Nemaha county	Desprez				
609	Hon. R. W. Furnas	Brownville, Nemaha county	Lane's Imperial				
610	Hon. R. W. Furnas	Brownville, Nemaha county	Lemaire				
611	E. S. Nesbitt	Crawford, Dawes county		June 8	Oct. 29		
612	E. S. Nesbitt	Crawford, Dawes county		June 8	Oct. 29		
613	E. S. Nesbitt	Crawford, Dawes county		June 8	Oct. 29		

TABLE IX—CONTINUED.

Serial number.	Season.																								Weight of Beet.		Total Solids.	Per Cent of Sugar.		Purity.
	April.			May.			June.			July.			August.			September.			October.			November.								
	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	Pounds.	Ounces.		Sucrose.	Glucose.	
580	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	....	14	29.6	21	0.051	70.9
581	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	....	8	26.2	21	0.093	80.1
582	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	....	6	24.4	21	0.101	86
583	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	....	10	23.5	18.5	0.027	78.7
584	51.1	1.98	5.9	58.4	2.22	8.1	72.7	3.63	7.9	78.7	2.02	5.4	71.4	2.18	8.2	62.1	0.91	2.9	50	0.92	3.6	38.8	0.72	2.3	....	10	25.6	20.4	0.049	79.6
585	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	....	21.4	17	0.119	79.4
586	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	3	19.7	16.4	0.089	83
587	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	13	20.6	17	0.188	82
588	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.81	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	11	23.1	17	0.035	73.5
589	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	13	24.3	20	0.042	81
590	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.29	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	8	23.4	17	0.073	72.6
591	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	10	22	16	0.143	72.7
592	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	11	21.8	16.2	0.063	74.3
593	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	11	24.8	19.1	0.032	77
594	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	14	23.2	19.1	0.134	81.8
595	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	6	22.2	17	0.051	76.5
596	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	10	14.5	13	0.050	89.6
597	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	12	18.8	13.1	0.044	69.6
598	*48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	5	19.7	16.9	0.037	85
599	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	12	14.4	11	0.038	76.3
600	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	....	7	12.6	10.4	0.055	82.3
601	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	1	14.9	11.5	0.084	77.1
602	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	....	14.1	11.6	0.040	82.2
603	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	8	12.9	9.5	0.071	73.8
604	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	3	14.1	11.4	0.051	80.8
605	48.6	3.23	9.8	56.3	1.13	6.8	70.5	1.22	5.4	77.9	1.16	4.7	71.7	1.84	6.2	63	0.26	1.3	49.6	0.45	1.8	38.9	0.46	1.8	1	4	14.9	13.2	0.047	88.5
606	*55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	10	15.7	10.5	0.056	66.8
607	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	2	2	15.9	12.8	0.072	80.5
608	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	2	4	17	14.6	0.077	85.8
609	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	13	16.6	12.5	0.034	75.8
610	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	11	16.4	14.6	0.059	89
611	*53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	2	4	22.3	17	0.144	76
612	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	2	2	17.7	12.9	0.171	73
613	53	1.49	4.4	58	3.34	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	2	....	16.1	12	0.101	75

* Mean of section.

TABLE IX—CONCLUDED.

Serial number.	GROWER.	POSTOFFICE ADDRESS.	Variety of Beets Grown.	Time of Planting.	Time of Harvesting.	Kind of Soil.	Amount of Cultivation.
614	E. S. Nesbitt	Crawford, Dawes county		June 8	Oct. 29		
615	E. S. Nesbitt	Crawford, Dawes county		June 8	Oct. 29		
616	E. S. Nesbitt	Crawford, Dawes county		June 8	Oct. 29		
617	E. S. Nesbitt	Crawford, Dawes county		June 8	Oct. 29		
618	B. Bird	Benkleman, Dundy county					
619	B. Bird	Benkleman, Dundy county					
620	B. Bird	Benkleman, Dundy county					
621	B. Bird	Benkleman, Dundy county					
622	George Edgeton	Creighton, Knox county		May 10	Nov. 1	Black loam	Plowed.
623	George Edgeton	Creighton, Knox county		May 10	Nov. 1	Black loam	Plowed.
624	Hon. R. W. Furnas	Brownville, Nemaha county		May 13	Nov. 10	Prairie	Same as corn.
625	Hon. R. W. Furnas	Brownville, Nemaha county		May 13	Nov. 10	Prairie	Same as corn.
626	Hon. R. W. Furnas	Brownville, Nemaha county		May 13	Nov. 10	Prairie	Same as corn.
627	Hon. R. W. Furnas	Brownville, Nemaha county		May 13	Nov. 10	Prairie	Same as corn.
628	J. Knowles	Somerset, Lincoln county					
629	J. Knowles	Somerset, Lincoln county					
630	E. Browser	Alma, Harlan county					
631	E. Browser	Alma, Harlan county					
632	E. Browser	Alma, Harlan county					

TABLE IX—CONCLUDED.

Serial number.	Season.																								Weight of Beet.		Total Solids.	Per Cent of Sugar.		Purity.
	April.			May.			June.			July.			August.			September.			October.			November.								
	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	T.	R.	R. D.	Pounds.	Ounces.		Sucrose.	Glucose.	
614	53	1.49	4.4	58	3.84	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	11	19.1	18	0.126	63
615	53	1.49	4.4	58	3.84	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	8	18.8	18.8	0.124	74
616	53	1.49	4.4	58	3.84	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	9	22.4	18	0.075	80
617	53	1.49	4.4	58	3.84	10.8	72.5	6.54	10.6	76.9	2.6	7	69.1	2.06	10.1	61.7	1.84	5.6	50.3	1.39	6.1	39.4	0.63	2.9	1	9	22.9	18	0.060	79
618	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	2	4	19.3	18.2	0.012	69
619	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	12	17.4	13.6	0.010	78.1
620	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	10	17.8	13	0.010	73
621	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.4	0.76	2	1	......	18.8	13.2	0.099	70
622	48.4	2.34	8	55.2	3.28	9	......	......	......	74.4	3.98	9	67.3	0.95	6	59.3	1.98	8	46.6	1.24	5	34.8	0.93	2	1	8	20.4	16	0.076	79
623	48.4	2.34	8	55.2	3.28	9	......	......	......	74.4	3.98	9	67.3	0.95	6	59.3	1.98	8	46.6	1.24	5	34.8	0.93	2	1	......	24.2	19	0.051	79
624	*55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	11	17	11.2	0.080	65.8
625	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	10	15.2	11.8	0.066	76.8
626	55.2	1.08	3.9	61.3	2.82	8.9	75.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	4	18.4	15.2	0.040	82.4
627	55.2	1.08	3.9	61.3	2.82	8.9	72.4	4.11	8.1	78.8	3.24	5.3	71.4	2.88	8.7	62.4	1.39	3.7	52	1.38	4.8	41.2	1.25	2.4	1	4	18.5	16	0.059	80
628	50	4.46	12	58	0.9	9	70	2.06	7	74	0.39	8	71	2.42	10	68	0.19	8	51	0.84	4	39	0.42	1	......	13	23.3	17	0.331	73
629	50	4.46	12	58	0.9	9	70	2.06	7	74	0.39	8	71	2.42	10	68	0.19	8	51	0.84	4	39	0.42	1	1	4	18.5	12	0.462	64.8
630	*50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.9	0.76	2	1	4	10.9	7.3	0.531	56.4
631	50.3	2.7	5.2	61	1.25	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	39.9	0.76	2	1	5	10	5	0.532	50
632	50.3	2.7	5.2	61	1.29	5	76.6	3.59	7.5	84.8	1.07	4.3	76.2	2.14	5	62.9	0.48	1.9	52.2	0.38	2	29.9	0.76	2	1	8	9.9	4.9	0.695	49.4

*Mean of section.

STATEMENTS OF INDIVIDUAL GROWERS.

Owing to various causes it was very difficult to get much information in regard to the essential questions of cost, yield, and cultivation.

In order to bring out certain facts we have selected, from the condensed tabular statement already given, certain beets, and, in addition to what appears there, we give the statement of the growers as communicated in letters sent with the beets. By referring to the corresponding number in the table, one can get at the other factors should he wish to consult them.

MR. MICHAEL O'CONNOR.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
578	....	Sioux county..................	12	20	78.7
*579	....	Sioux county..................	9	23.2	78.6
580	....	Sioux county..................	14	21	70.9

* These beets were quite badly wilted when they were received for analysis.

In regard to beets Mr. O'Connor says: "The beets were planted about May 25. The ground was broken in the fall of 1888, about three inches deep, and remained uncultivated until the spring of 1890, when it was plowed eight inches deep. The beets were cultivated altogether with a hoe. The yield, which I can only estimate, would be about seven tons per acre. The season of 1890 has been unusually dry and many crops failed entirely. Beets did exceedingly well."

MR. L. A. GANSON.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
406	Vilmorin...........................	Cheyenne county............	14	17	71
407	Vilmorin	Cheyenne county............	14	15	70

Mr. Ganson says: "Beets were planted about the 8th of April with a 'Planet Junior seed drill,' in rows about twenty inches apart. They were cultivated four times during the season with a garden cultivator and hoed twice. Harvested October 21. The season was extremely dry, so dry that we raised no corn; yet I have a nice lot of beets. I consider them a sure crop. Have raised them for twelve years for stock food."

MR. J. C. WOLF.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
418	Klein Wanzlebener.............	Cheyenne county...........	9	18.9	88
419	Klein Wanzlebener.............	Cheyenne county...........	11	15	78

Mr. Wolf says: "Seed was planted about June 15; came up all right but did not grow any until August 1, when I arranged to have them irrigated from the creek; from that date the growth was wonderful, and I have harvested two wagon

loads of beets from four square rods of ground. The beets were given ordinary cultivation, just enough to keep the weeds down, and were irrigated twice. They were harvested October 20."

MR. J. T. RIVETT.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
332	Desprez	Culbertson	11	17	75

In regard to beets Mr. Rivett says: "The soil was a dark loam which had been plowed and cropped for four seasons. The preceding crops had been corn for one year and potatoes for two years, the potatoes immediately preceding the beets. Seed was planted May 15, and beets harvested October 1."

MR. R. VAN METER.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
400	No. 1	Perkins county	8	18	75
401	No. 2	Perkins county	12	21	82
402	No. 3	Perkins county	8	21.3	83
403	No. 4	Perkins county	9	20	84
404	No. 5	Perkins county	12	20.6	89

Mr. Van Meter states that "These beets were grown on table-land which had been from two to four years under cultivation. Seed was planted about the last of May. They were hoed twice and cultivated twice with a Planet Junior cultivator."

MR. G. W. FAIRFIELD.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
356	Desprez	Scott's Bluff county	18	13.6	82
357	Klein Wanzlebener	Scott's Bluff county	14	15	80
358	Lemaire	Scott's Bluff county	11	14.6	79
359	Lane's Imperial	Scott's Bluff county	11	14.7	84

Mr. Fairfield writes as follows: "The seed was planted on the 15th of May, in a dark, rich, alluvial, bottom soil, somewhat sandy and somewhat tinctured with alkali. They were cultivated with a garden cultivator three times during the season and irrigated twice. They did not get the attention they should have to produce beets of a larger size and better quality. They were harvested on the 15th day of October."

MR. H. MONTGOMERY.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
217	Vilmorin	Furnas county	6	12.7	88
218	Klein Wanzlebener	Furnas county	18	12	81
219	Desprez	Furnas county	16	13.5	80
220	Vilmorin	Furnas county	21	12	70
290	Klein Wanzlebener	Furnas county	17	16.6	83
291	Vilmorin	Furnas county	5	15	77
292	Florimond Desprez	Furnas county	6	13.5	74
293	Florimond Desprez	Furnas county	8	12.9	71

In regard to cultivation Mr. Montgomery says: "I planted from the 5th to the 7th of May three plats as follows: No. 1, on low creek bottom; No. 2, on second bottom; No. 3, on table-land. I did this to determine which location was best. On plat No. 1 seed was sown by hand in rows twenty inches apart. In plats No. 2 and No. 3 the rows were sixteen inches apart. I got a good stand in plats No. 2 and No. 3. In plat No. 1 the soil is gravelly and the seed failed to germinate. My beets were thinned to from six to nine inches apart, and have been cultivated once a week and kept perfectly clean and the soil loose. I used a McGee wheel hoe. They have stood the dry season much better than anything else. Corn, beans, and all vegetables perished for want of rain, while the beets remained perfectly fresh and green. They were harvested October 7. I cannot give exact yield per acre, as I had a very irregular stand, owing to the dryness of the soil, but I estimate it at about ten tons per acre.

MR. G. W. BUSHONG.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
618		Dundy county	36	13.2	69
619		Dundy county	28	13.6	78
620		Dundy county	26	13	73
621		Dundy county	16	13.2	70

Mr. Bushong writes that his soil is a dark, sandy loam that was first broken three years ago and had produced one crop of sod-corn and two crops of potatoes. The ground was plowed ten inches deep and thoroughly harrowed. Beets were planted May 15, in rows eighteen inches apart. They were hoed once and afterwards cultivated the same as corn. His estimated yield is thirty tons per acre.

MR. BENJAMIN BIRD.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
589	Klein Wanzlebener	Banner county	18	20	81

Mr. Bird writes: "These are the first beets I ever raised, and if my method of cultivation is worth anything to the public I cheerfully give it. In the start I will say that the beets were grown upon high prairie, the buffalo-grass sod having been turned two years prior to the cultivation of the beets. I planted seed on the 12th day of May, in rows twenty inches apart. My ground was well pulverized to the depth of eight inches. I planted in small furrows three inches deep, covering to a depth of one inch. As soon as the plants were up I chopped the surface of the ground very fine with a hoe to kill any weeds that were coming up. When the beets had four leaves I thinned them to a distance of from six to eight inches apart, and pulled all weeds from the little furrows in which they were growing. In about ten days I hoed the surface between the rows, after this I used a small cultivator to keep the ground well pulverized. The beets began growing very rapidly, and I hoed the rows, pulling the dirt well around the beets. I raised 16½ tons per acre."

EXPENSE OF RAISING.

One day with team preparing the ground	$2.00
One day planting	1.00
Two days' hoeing	2.00
One day cultivating	1.00
Two days' gathering with two men	4.00
Seed	.80
Total	$10.80

MR. CLARK KRICKBAUM.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
586		Banner county	19	16.4	83
587		Banner county	13	17	82

Mr. Krickbaum writes: "My beets were raised in the valley of Pumpkin creek. The soil is a gravelly loam, which had been cropped for three seasons. Seed was planted the 10th of May. They were hoed twice and harvested in the middle of October. We had no rain from June until after the beets were harvested. They looked very fresh and thrifty during the summer, even after all other crops had been killed by the drought."

MR. E. S. NESBITT.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
611		Dawes county	36	17	76
612		Dawes county	34	12.9	78
613		Dawes county	32	12	75
614		Dawes county	27	13	68
615		Dawes county	24	13.8	74
616		Dawes county	25	18	80
617		Dawes county	25	18	79

Mr. Nesbitt says that "the soil was a dark, rich, sandy loam and had been in constant cultivation since 1880, being one of the first *pieces* broken in the vicinity. It had produced wheat, corn, oats, potatoes, and vegetables. The season was the driest I have seen here in nine years' residence. Seed was planted June 8. The plants were simply hoed three times—no other cultivation—and were harvested October 29. They withstood the season better than anything else upon the place.

MR. A. H BEMIS.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
568	Nonpareil	Seward county	8	16.4	74
569	Nonpareil	Seward county	5	15.1	86
570	Nonpareil	Seward county	11	12.1	78
571	Nonpareil	Seward county	13	11	64

Mr. Bemis writes: "Seed was planted about the 10th of June, on bottom land, in rows about seventeen inches apart. When the plants were up they were thinned to a distance of four inches. Owing to the dry season I had a very small stand. I raised five acres of beets for Grand Island. Had about seven tons to the acre. They graded about 14 per cent sugar. I find that they are an excellent food for stock and shall raise them next year for that purpose."

MR. J. F. BLAINE.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
319	Lemaire	Fillmore county	21	13.5	75
320	Desprez	Fillmore county	16	12.7	70
321	Klein Wanzlebener	Fillmore county	11	13.5	73

"We have had a very dry season and the beet seed was received a little late. I have not nursed them, but simply planted in good ground and gave them only such care as a good farmer should give a staple crop, as that is the standard by which they must be tried. Can give no estimate of cost of raising or yield per acre, as I had but a small plat and the work was done at odd spells. I can say that I can raise a good crop of beets in a poor corn year."

MR. ISAIAH ALLEY.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
381	....	Jefferson county	32	12	73
382	....	Jefferson county	14	13	70
383	....	Jefferson county	14	16	82

"Seed was sown the 15th of April, in rows thirty inches apart, in rich, black, sandy loam, with a loose subsoil. When plants first came up, I used a steel rake to destroy the weeds; after two weeks, cultivated with a hand cultivator and a hand hoe until crop matured. The season was very hot and dry. No rain at all fell during the month of July, which caused the beets to be small. The Desprez grew the largest and ran down the deepest into the soil and were the best shape."

MR. J. STOCKDALE.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
514	....	Saunders county	18	16	73
515	....	Saunders county	12	17	75

Mr. Stockdale writes: "My soil is very sandy; a dark sand on the surface and eighteen inches below a white sand. This land had been cropped to corn for several years, and for four years previous to using it for beets it was sowed to blue grass. I plowed the blue grass under the fall previous to planting and harrowed the sod thoroughly. In the spring I plowed and harrowed the ground again. The 25th of May I planted the beets in rows eighteen inches apart, and when up, thinned to six inches in the row. I cultivated with the hoe three times. I cannot estimate the cost of cultivation, as I did the work at odd times. The season was very dry, especially this plat of ground, which sloped to the south and east. My beets did better than anything else I planted, except, perhaps, sweet potatoes. They were harvested about the middle of October."

MR. W. B. EARL.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
487	....	Holt county......................	8	12	74
488	....	Holt county......................	8	13.5	89
489	....	Holt county......................	25	15	81
490	....	Holt county......................	17	16	81

Mr. W. B. Earl writes as follows: "The land was first broken in the summer of 1886 and planted to corn in 1887; in 1888 it was planted to onions; in 1889 it was planted to a variety of small vegetables. Beets were planted the 27th of May. After they were up, were cultivated and weeds hoed out June 14. They were thinned by selecting the largest in the bunch and cutting the rest off just below the surface of the ground with a knife. They were cultivated again in July, and harvested about October 30. The season was all that could be desired, except about two weeks in the latter part of July or the first part of August, which was a little too dry for corn to fill good. The beets seemed to grow just the same."

MR. DUANE BROWN.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
465	....	Washington county.........	19	16.4	84

Mr. Brown says: "The beets sent you were raised in a light sandy loam made by the action of the Missouri river, the bed of which was located on that point fifteen years ago. This land had raised corn previous to this crop and was plowed, thoroughly harrowed, and marked out in rows thirty inches apart. Seed was sown the 20th of May; got a good stand; plants coming up in about a week. Soon after they were up we had a heavy, washing rain which covered up about one-half of them. I thinned what remained to a distance of from six to eight inches apart and worked with a hoe once a week until the plants pretty well covered the ground. The beets were as little affected by the hard season as any crop we had. I can safely say that with a full stand there would have been at least twenty-four tons to the acre."

MR. URIAH BRUNER.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
251	Florimond Desprez	Cuming county.................	30	9.9	63
252	Klein Wanzlebener............	Cuming county.................	20	13.1	78
253	Klein Wanzlebener............	Cuming county.................	13	14	82
462	Klein Wanzlebener............	Cuming county.................	8	11.5	76

Mr. Bruner writes: "Seeds were planted about May 20. The soil is a rich, sandy loam; manured heavily last year with ordinary stable manure; not manured this year."

MR. GEORGE D. EDGETON.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose — Per Cent.	Purity.
622	....	Creighton	24	16	79
623	....	Creighton	16	19	79

Mr. Edgeton writes: "Beets were raised in a black, sandy loam in which corn had been previously raised. The ground had been under cultivation for sixteen years. Beets were planted May 16, and received ordinary cultivation. I estimate the yield at twenty tons per acre. They were harvested the middle of September. The season was dry. Beets stood the drought better than other crops."

G. H. RODGERS.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
812	Lemaire.	Keya Paha county............	13	15	79
813	Klein Wanzieben..................	Keya Paha county............	16	18	78
814	Desprez................................	Keya Paha county............	14	14	71

Mr. Rodgers writes as follows: "Beets were sown the 15th day of May. Some of these came up in eight days; all of them in ten days. When they had been up from five to seven days there was a very heavy rain that buried very nearly all of these, so that I did not get a very good stand. The rows were sixteen inches apart. Was hoed once in June, twice in July, and once in August, just deep enough to cut the weeds off under the surface of the ground. Beets were harvested the 15th day of October. The soil in which they were grown is ablack, sandy loam with a clay subsoil, on the highest table-land in the county. It is known as "salt-grass land." This land has been under cultivation six years, growing wheat, corn, oats, onions, and potatoes. We had heavy rains in May and the first of June; after that only one light shower in July and one in August. I cannot see that the beets showed any effects of the dry weather. They kept green and growing all the time. Other crops showed the effects of the drought very much."

MR. GEORGE J. CURRY.

No.	Variety.	Location.	Net Weight—Ounces.	Surcose—Per Cent.	Purity.
411	No. 2....................................	Rock county.............	20	13.5	76
412	Desprez................................	Rock county.......................	12	15.3	80
413	Desprez................................	Rock county.......................	12	14.1	75
414	Lemaire................................	Rock county.......................	20	16	85
415	Lemaire................................	Rock county.......................	9	16	75
416	Klein Wanzlebener..............	Rock county.......................	8	17	80
417	Klein Wanzlebener..............	Rock county.......................	15	20	88

Mr. Curry writes in regard to his beets: "The soil was a dark, sandy loam, sloping to the south; good corn ground, neither high nor low, just middle; covered with a light coating of stable manure and plowed to a depth of six inches. The beets were planted May 26. After they were up, were thinned to a distance of from five to eight inches apart and cultivated with a horse cultivator and hoed

three times. Were harvested October 30. Can give no estimation of yield or cost. The season was exceedingly dry, less water in the ground than in the last six years. Beets stood the drought better than any other crop."

MR. A. H. GALE.

No.	Variety.	Locality.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
478	Klein Wanzlebener	Rock county	12	13	78
479	Klein Wanzlebener	Rock county	8	15	81
480	Klein Wanzlebener	Rock county	8	14.6	75

In sending his beets Mr. Gale sends the following in regard to cultivation: "The soil was sandy, with a magnesia subsoil which was very hard, and when dry almost impossible for roots to penetrate. This season this subsoil was like an adobe brick. Under this hard stratum was plenty of moisture, but on the surface soil above it there was hardly any. During August to September the surface soil was like an ash heap. Beets were planted May 20 and harvested October 20. No fertilizer was used."

MR. H. B. WILSON.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
282	Lemaire	Adams county	9	14.2	81
283	Vilmorin	Adams county	22	17.3	82
284	Klein Wanzlebener	Adams county	12	13.3	76

Mr. Wilson writes: "Beets sent you were all planted May 6 with a seed drill; were hoed with wheel and hand hoe before thinning; after thinning were hoed twice with wheel hoe, and once with hand hoe, and cultivated once with horse cultivator. There were no weeds left to interfere with the crop. The season was very dry, only one rain, and that a light one after the beets came up. The soil is a common black loam and was plowed the previous autumn. Yield was small."

MR. L. G. BABCOCK.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
438	No. 1	Antelope county	21	13	81
439	No. 2	Antelope county	13	15	85
440	No. 3	Antelope county	23	14	77

Mr. Babcock says in regard to cultivation: "Seed was planted May 10, in a black loam with a clay subsoil. They were hoed once. The rest of the work was done with a plow. Harvested November 6. Yield, sixteen tons per acre. Cost of raising, per acre, $10. We did not have any rain from the 21st of June until the 20th of August. Drought affected the beets the least of any crop we had."

MR. C. E. WARD.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
213	Lemaire	Thayer county	22	12	58
214	Desprez	Thayer county	16	12	78
215	Desprez	Thayer county	10	13.5	80
216	Klein Wanzlebener	Thayer county	17	10.5	63

Mr. Ward says: "I planted, May 10, three acres in a deep, black loam with clay subsoil. After coming up they were thoroughly harrowed and cultivated, and thinned to distance of from six to eight inches. All work done by hand. Harvested October 20. Cost to raise, $15.75 per acre. Yield, eight tons per acre. These beets were sent to the factory at Grand Island, at a cost of eighty cents per ton freight. Price received at factory, $3.20. The season was very dry, which greatly reduced the tonnage yield."

MR. CHARLES J. NELSON.

No.	Variety.	Location.	Net Weight—Ounces.	Sucrose—Per Cent.	Purity.
470	No. 5	Dawson county	12	14.4	81
471	No. 1	Dawson county	15	14	74
472	No. 2	Dawson county	11	15.8	81
473	No. 3	Dawson county	9	14.1	76
474		Dawson county	12	16	85
475	No. 4	Dawson county	12	13.5	78
476	Desprez	Dawson county	15	12	74

"Seed was planted the 17th of May, during very dry weather. After beets were up they were thinned to a distance of six to eight inches and were cultivated with horse-hoe and harrow. I cultivated them twice and hoed them once. The season was very dry. The last of June we had a terrible hail storm; after that time it was very hot and dry until beets were harvested, the 30th of October. Yield, fifteen tons per acre. Cost of cultivation, I should think about $10 per acre. The beets stood the drought better than any other crop."

These statements of the beet growers show very clearly what and how much, or better, how little, cultivation beets received. What is of much more value to the future of the industry is the tacit admission running through those statements that beets did not receive the careful and thorough cultivation that all admitted was necessary.

Another important statement that is characteristic of these letters, and to which we invite particular attention, is that the beets were the least affected by the adverse season of any crop raised. In this is an important argument for the diversification of farm crops. Here is a crop that is almost certain in a season that is destructive to ordinary grains and grasses. A man who, this season, has a few acres of beets has that which will enable him to carry his stock through the winter even if his other crops have been almost total failures.

BEST VARIETIES.

While no positive conclusion can be drawn as yet as to which of the varieties used will do the best in this state, or in any particular part of this state, yet it is

of much interest to see how the different varieties compare with each other in sugar-content and purity. For this purpose we have placed in tabular form the average in weight, sugar, and purity of the four principal varieties used for the threedistricts into which we divide the state.

Tables of Averages in Net Weight, Sucrose, and Purity of the Principal Varieties of Beets Grown in 1890.

VARIETY.	SOUTHERN DISTRICT.			MIDDLE DISTRICT.			NORTHERN DISTRICT.		
	Net Weight—Ounces.	Per Cent Sucrose.	Purity.	Net Weight—Ounces.	Per Cent Sucrose.	Purity.	Net Weight—Ounces.	Per Cent Sucrose.	Purity.
Klein Wanzlebener	17	13	80	15.4	13.5	80	15	15.4	80
Vilmorin	14.2	13.3	79	18	15.1	82	16	14.5	75
Desprez	17	13.5	83	17.7	13.4	82	13	13.7	74
Lemaire	14.7	13.4	79.3	11.5	14	77	15	14.8	76.5
	15.7	13.3	80.2	14.4	14	80	14.7	14.6	76.4

Considering only the three factors of weight, sucrose, and purity, the Klein Wanzlebener and Desprez have given the best average results for the season. In the northern district the Klein Wanzlebener, with the average net weight of 15 ounces and average sucrose percentage of 15.4, average purity of 80 per cent, has been the best variety this season.

In the middle district Vilmorin has had an average net weight of 14 ounces, sucrose percentage of 15.1 per cent, and a purity of 82 per cent.

In the southern district the Desprez has been the best variety raised, with an average net weight of 17 ounces, sucrose 13.5 per cent, the purity 83 per cent.

It should be remembered that the season in the northern district was at least two weeks shorter than that in the other districts; that the season in the middle district varied in its meteorological conditions the least of any from the normal, while the southern district had the longest, and, comparatively speaking, the most abnormal season.

The following table, giving the average number of rainy days in the months from April to November inclusive, is here inserted to give the reader a fair idea of how our rainfall is distributed in time. The figures are furnished by the Nebraska Volunteer Weather Service:

TABLE X.

Showing the Number of Rainy Days in the Months from April to November Inclusive.

STATION.	April.	May.	June.	July.	August.	September.	October.	November.	Length of Record.	Time.
Ashland, Saunders	9.0	8.6	8.7	7.7	6.5	6.4	4.7	3.7	6	84-90
Cedar Bend, Gage	6.2	6.8	9.8	7.2	5.8	3.7	6.0	2.0	4	78-83
Crete, Saline	7.8	9.2	8.8	8.2	5.8	6.0	5.0	2.4	11	80-90
David City, Butler	6.5	4.5	9.5	6.0	5.0	3.0	5.0	2.5	2	89-90
DeWitt, Saline	4.7	5.8	7.2	7.3	6.0	7.6	6.0	2.0	7	79-87
Fairbury, Jefferson	7.4	7.9	7.5	10.7	8.3	5.9	4.4	2.2	6	84-90
Falls City, Richardson	8.8	7.8	9.3	6.8	7.2	7.0	3.4	2.5	6	84-89
Hebron, Thayer	3.0	7.0	8.0	6.0	9.0	3.0	3.0	3.0	1	1890
Marquette, Hamilton	8.8	7.8	8.7	8.0	8.4	4.9	6.0	2.7	6	84-90
Nebraska City, Otoe	7.6	9.5	8.9	8.4	9.7	5.7	4.9	3.0	7	83-90
Pawnee City, Pawnee	3.8	5.7	7.2	6.6	3.8	5.5	4.8	2.6	6	78-83
Peru, Nemaha	3.8	6.3	10.0	4.8	4.0	5.5	4.0	1.0	4	79-84
Stromsburg, Polk	9.0	10.0	8.0	8.2	9.2	8.3	5.0	3.0	4	84-87
Stockham, Hamilton	9.2	9.2	8.6	10.1	8.8	6.8	4.8	3.0	5	80-86
Superior, Nuckolls	5.8	7.6	6.6	7.0	6.7	3.2	5.6	2.0	6	79-85
Syracuse, Otoe	8.5	9.3	8.7	7.0	7.9	5.6	5.2	1.8	8	88-90
Table Rock, Pawnee	6.2	8.5	7.5	8.0	4.5	5.0	6.0	1.8	4	81-84
Tecumseh, Johnson	5.2	7.2	6.6	7.2	6.5	4.6	5.1	2.2	6	78-90
Weeping Water, Cass	8.2	10.0	9.5	4.8	6.3	6.0	5.2	3.3	13	78-90
York, York	9.7	7.5	7.0	8.5	....	7.0	6.5	2.7	3	84-86
Creighton, Knox	4.0	9.0	10.0	13.0	4.5	5.0	4.0	3.5	2	88-90
DeSoto, Washington	8.8	12.0	10.6	9.4	9.0	8.6	6.4	4.2	12	78-90
Craig, Burt	6.0	9.0	10.0	10.0	6.0	7.0	4.0	4.0	1	1889
Fremont, Dodge	7.8	11.5	10.3	9.5	8.9	7.4	5.8	3.9	13	78-90
Norfolk, Madison	5.0	6.0	3.0	10.0	8.5	8.0	9.5	....	2	82-84
Oakdale, Antelope	5.7	12.0	11.7	8.7	9.3	5.0	4.0	3.5	3	78-90
Omaha, Douglas	8.2	13.0	11.6	10.0	8.9	8.7	5.3	4.3	13	88-90
Tekamah, Burt	4.0	8.0	8.0	5.0	10.0	4.0	8.0	2.0	1	1890
West Hill, Platte	5.6	8.9	9.9	9.1	8.8	6.5	4.5	2.4	12	79-90
West Point, Cuming	5.7	9.6	7.0	8.0	7.3	7.4	3.5	3.8	7	84-90
Alliance, Box Butte	3.0	1.0	8.0	8.0	6.0	5.5	6.5	3.0	1	89-90
Bassett, Rock	....	....	10.0	2.0	9.0	2.0	2.0	2.0	1	1890
Bingham, Sheridan	5.0	9.0	9.0	9.0	7.0	6.0	2.0	....	1	89-90
Hay Springs, Sheridan	8.6	2.5	7.4	6.6	8.0	2.5	5.6	3.7	5	86-90
Kennedy, Cherry	8.5	8.0	8.5	8.5	6.0	4.0	4.5	2.0	2	89-90
Valentine, Cherry	7.2	12.4	11.0	10.7	8.2	6.2	6.6	2.6	4	87-90
Ansley, Custer	4.0	4.5	8.5	6.5	7.0	4.5	2.0	1.0	2	89-90
Grand Island, Hall	3.0	8.0	....	4.0	10.0	5.0	2.0	3.0	1	89-90
Lexington, Dawson	6.0	6.0	7.0	4.0	9.0	4.0	2.0	2.0	2	89-90
North Loup, Valley	6.0	8.0	12.0	8.0	8.5	6.0	4.0	4.0	2	89-90
Palmer, Merrick	4.8	7.5	6.0	5.2	4.6	3.6	1.0	1.6	5	86-90
Ravenna, Buffalo	7.8	9.6	8.1	8.9	7.1	5.4	5.5	3.1	13	78-90
Sargent, Custer	5.9	8.0	7.4	7.4	6.9	3.0	3.5	2.2	7	83-90
Gering, Scott's Bluff	11.0	11.0	3.0	5.0	7.5	1.5	4.0	2.0	2	89-90
Kimball, Kimball	5.0	10.0	4.5	7.0	6.3	1.0	2.5	0.0	2	88-90
North Platte, Lincoln	10.0	11.9	10.4	9.1	9.6	4.8	4.5	3.2	13	78-90
Culbertson, Hitchcock	8.0	4.0	13.5	10.0	6.5	4.0	5.5	4.0	3	88-90
Grant, Perkins	5.0	3.0	6.0	....	3.0	1.0	4.0	1.0	1	1890
Inavale, Webster	4.4	7.6	7.3	7.3	4.2	5.0	5.6	1.2	7	78-84
Keene, Kearney	6.0	8.5	6.0	9.0	5.0	4.0	4.5	4.0	2	84-85
Minden, Kearney	7.3	9.6	9.6	10.1	8.5	6.4	5.0	2.9	11	78-90
Red Willow, Red Willow	7.4	11.0	7.2	6.8	7.2	4.7	4.6	1.0	7	82-89
Mean for state	6.1	8.6	9.1	8.6	6.8	4.5	4.3	2.8	....	....

INSECT ENEMIES.

Early in the season reports from the field agents and others gave warning that in some places destructive insects had begun work on the beets. As there are several kinds of insects that are destructive to these roots, it seemed the proper time to begin to study their habits and to learn the best means of meeting or warding off their attacks.

The growers at the sub-stations, and our field agents especially, were early instructed to keep careful watch and note all insects feeding on the roots or the leaves of the beets. They were told to search at different times in the day and in the evening for these insects and when found to note the conditions under which they were found and to send the insects to Mr. Lawrence Bruner, station entomologist, for study and identification.

Mr. Bruner makes the following report in regard to insects found to be most injurious during last season, accompanied by suggestions as to means to be taken to protect the beets against them:

THE GARDEN WEB-WORM.

(*Eurycreon rantalis* Guen.)

One of the most, if not the most, destructive of our beet insects up to the present time has been the one shown in Fig. 1. It is known by the name of the Garden Web-worm, from the fact that it spins a web while feeding; and "Garden," because it is a garden frequenter rather than a field inhabitant. Systematically it belongs to the family of moths which bear the name of *Pyralidæ*, the members of which are all more or less injurious. It has been quite thoroughly treated in Professor Riley's annual report to the Commissioner of Agriculture for the year 1885, pp. 265–270. I will therefore quote quite largely from that source.

In referring to the distribution of this insect that author writes as follows: "*Eurycreon rantalis* is quite a wide-spread species, occurring all over the United States. It has been captured in South America, and the original description of the species was from a specimen from Montevideo. It is also a very variable species, and has been variously described under the names of *crinisalis*, by Walker; of *communis*, by Grote, and of *occidentalis*, by Packard."

DESCRIPTIVE.

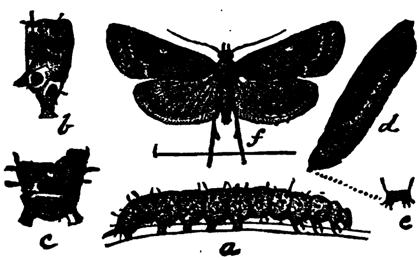


FIG. 1.—Garden Web-worm (*Eurycreon rantalis*): *a*, larva; *d*, pupa; *f*, moth—all slightly enlarged. [After Riley.]

"The moth (Fig. 1, *f*) has an average expanse of 18mm. The general color is either orange or reddish-yellow, inclining to buff, or more commonly a lighter or darker shade of gray, having, in certain lights, either a copperish or greenish reflection very similar to that on the well known Cotton Worm Moth (*Aletia xylina*). The characteristic markings, as shown in the figure, are the darker reniform and orbicular spots, with a paler shade between them;

two irregular transverse pale lines, generally relieved by darker shade, most intense posteriorily on the anterior line and basally or interiorily on the posterior line. The terminal space may be either paler or darker than the ground color. The markings are very variable, however, dark specimens (*rantalis*) having them all well defined, paler specimens (*communis*) less so, while in others (*crinisalis*) the anterior line and inner portion of posterior line may be lacking."

"The larva * * * is also somewhat variable in color, being either pale or dark-yellow or even greenish-yellow. It is marked with rather distinct jet-black piliferous spots, as illustrated in the figure. The piliferous spots are also more or less distinctly relieved by a pale border.

"The pupa is of the normal brown color and characterized by the tip of the body having two prominences, each furnished with three stout, short pines."

Although this insect is known to extend over a remarkably large area, its injuries have thus far been confined to the region between the Missouri river and the Rocky mountains; nor has it been observed here to any great extent—at least, north of the Platte river. This area is, however, quite liable to be increased with the general cultivation of the soil in the beet belt.

FOOD-PLANTS.

Like many of our more injurious insect pests the "Garden Web-worm" is quite a general feeder. It is especially one that will need our watchful care if we hope to keep it within bounds, for it is one of the very few species that is a genuine weed-feeder. In fact, it is more partial to some of the weeds than it is to cultivated plants.

Professor Riley speaks of the food habits of this insect as follows in the report already referred to: "There is no question but that the preferred food of this species is the foliage of plants of the genus *Amarantus*, called in different parts of the country Amaranth, Pig-weed, and Careless weed. This was very noticeable in our observations of 1873, and its next preference seemed to be Purslane. Professor Snow also mentions Lamb's Quarter (also called "Pig-weed" *Chenopodium*), as a favorite food-plant. Prof. C. E. Bessey, writing from Lincoln, Nebraska, August 11, mentioned an unusual abundance of these larvæ upon *Amarantus retroflexus* and *A. blitoides*. Another correspondent mentions finding them the present year (1885) upon the common Cockleburr (*Xanthium strumarium*), but this was probably due to their excessive abundance and want of proper food. This, also, is probably the case with the common Burdock (*Lappa*), which is mentioned by another correspondent. Professor Popenoe mentions, among the weeds injured, *Amarantus alba*, *Chenopodium album*, *Ambrosia trifida*, *Apocynum cannabinum*, and *Grindelia squarrosa*. He also mentions the fact that they injured a bed of scarlet verbenas."

The following are the cultivated plants that it has been observed to feed upon: Corn, cotton, cabbage, cucumber, castor beans, melon, squash, pea, beans, red clover, alsike, alfalfa, pumpkin, sweet potato, Irish potato, egg plant, tomato, orchard grass, timothy, meadow oat grass, millet, flax, tobacco, sugar cane, lettuce, onions, and beets, besides others. Thus it will be seen that the insect is a more general feeder than might be at first supposed. In fact it appears to be able to feed on almost anything.

HABITS AND NATURAL HISTORY.

Under this heading, Professor Riley, whom I have already quoted largely, says: "The full natural history of the species has not yet been made out. The eggs have not been described, the method of hibernation is not positively known, and the number of annual generations has not been carefully determined."

The insect is evidently a many-brooded species, since indications point to at least three or four sets of moths during the spring, summer, and fall. The larva is a web-maker, and always spins as it goes and constructs a sort of retreat in which it remains during the day-time at rest. It is described by Professor Popenoe in the second quarterly report for 1880 of the Kansas State Board of Agriculture. He says: "The following points in its history are the partial result of my study of the insect. Although I made careful search for the egg, I failed to discover it *in situ*, but it is without doubt deposited on the lower side of a leaf, or low down among the bases of a cluster of leaves, as newly hatched larvæ are found in both these situations, from which they soon wander to other parts of the plant. As soon as it (the larva) begins to move about it begins to spin the web, and this increased in extent as the movements of the larva is extended. It is very active in all stages of growth as a larva, and springs aside quickly when touched, sometimes throwing itself into a coil, but more often running rapidly away. At least in early life the larva, when thrown off a leaf, will hang by a thread of silk. In case a single leaf is of sufficient size, as in the sweet potato, a well-grown larva is generally found on the upper side in a shelter formed by drawing partly together the edge of the leaf by the silk of its web. In this shelter it is generally found at rest during the day, hanging by its feet, back downward, to the lower surface of the web. In other plants several leaves may be drawn together for a place of concealment. If, indeed, the larvæ are not partially gregarious, they are at least not disturbed by proximity to each other, as several may be found at times in a common web, although I believe this is exceptional. As they are forced to move to new parts of the plant for fresh food their webs are extended until finally the entire plant is covered. The young larvæ devour only the surface and substance of the leaf on the side where they are, leaving the veins and the opposite epidermis untouched, producing a "skeleton" leaf. As they grow older, however, they devour all portions of the leaf, and often eat also the petioles and tender stems. Opportunity has not been given to determine the exact length of the larval life of this insect, but, judging from observations made, this cannot greatly exceed a week. Parties living in the region where the insect was present in great numbers give ten days as the length of the time in which the chief destruction was accomplished."

Although I have never paid personal attention to this insect, it is learned from the records of others that, when full grown, the larva spins for itself a delicate silken cocoon among the debris on the ground at the base of its food-plant, and transforms to the pupa or chrysalis stage. It remains in this last form from one to two weeks.

NATURAL ENEMIES.

Like all other injurious insects, this one is quite certain to have its insect enemies, both parasitic and predaceous. Some of the ground beetles, like those illustrated in Figs. 2, 3, and 4, feed upon the larvæ, while a Tachina fly has been bred from them in Kansas by Professor Popenoe.

Where the insect attacks the beet, and where the tops are not inetnded to be fed to stock, the best remedy will be the use of one or the other of the arsenical

FIG. 2.—*Calosoma calidum*: *a*, the beetle; *b*, the larva. [After Riley.]

sprays so often recommended for the destruction of other insect pests. These are composed of either London Purple or Paris green in the proportion of 1 pound to

FIG. 3.—*Harpalus caliginosus.* [After Riley.]

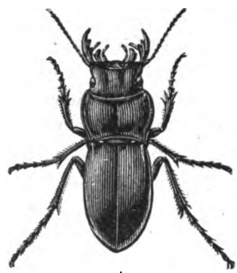


FIG. 4.—*Posimachus elongatus.* [After Riley.]

200 gallons of water, and applied with a sprinkler or force pump, the latter being the best.

THE PALE-COLORED FLEA-BEETLE.

(*Systena blanda.*)

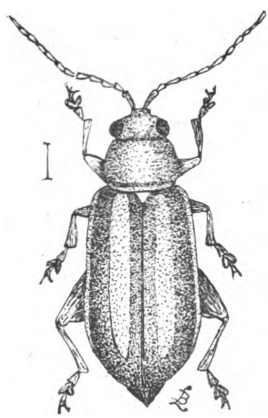


FIG. 5.—The Pale Flea-beetle (*Systena blanda*). [Original.]

This small pale-colored flea-beetle, which is shown in the accompanying illustration (Fig. 5), appears to be the most destructive of all the flea-beetles that are known to attack the beet. It has a rather wide range over the United States. It is found in the New England states, and thence westward to the Dakotas, from which latter point it is exceedingly common southward and westward to California and Arizona.

It is very variable in its color, as well as in its sculpturing, some specimens being almost black, while others are nearly yellowish-white, the color of the vittæ or stripes of the elytra. The insect also varies greatly in the amount and manner of its punctuation, from specimens in which this is deep and coarse to others that are almost smooth and glossy.

Its mode of attack is very similar to that of sev-

eral others of our smaller flea-beetles, *i. e.*, it gnaws the leaves full of holes upon either the upper or lower side. This is done in the beet by the insect eating away the outer parenchyma of the leaf, not reaching quite through, and thereby leaving the plant with a blister-like appearance similar to those affected by one of the diseases known as Leap-spot or Leaf-blight.

FOOD-PLANTS.

In addition to the beet this Systena has been taken while feeding upon the various species of the Amarantus, Chenopodium, Purslane, and white clover. In the latter it gnaws holes clear through the leaves instead of only part way. It also feeds sparingly upon the Cruciferæ.

REMEDIES.

Under the head of remedies against this flea-beetle can be mentioned the kerosene emulsion, and the arsenical sprays. The former has been tried by several of our correspondents with apparently good results. One of them, at least, wrote that the kerosene emulsion worked perfectly, and that none of the beetles were to be seen the next day. If the emulsion did not kill them, it at least drove them away, which is nearly as good. If the insects continue to appear and to attack the plants after the application of the emulsion, and it is not intended to use the tops for stock food, the arsenical spray will be effectual in their removal. No parasites were observed to attack this beetle, nor was it found among the insects contained in the stomachs of birds which have been examined here at the station to ascertain their food-habits. This does not, however, prove that it is not eaten by the feathered tribe.

OTHER FLEA-BEETLES.

In addition to the flea-beetle just mentioned there have been several others taken, while feeding upon the leaves of beets, and of course can be treated here. All of these have similar habits to those of the one just described above, but they vary somewhat in their size and appearance. Several of these are shown in Figs. 6, 7, and 8.

FIG. 6.—The Triangle Flea-beetle (*Disonycha triangularis*). [Original.]

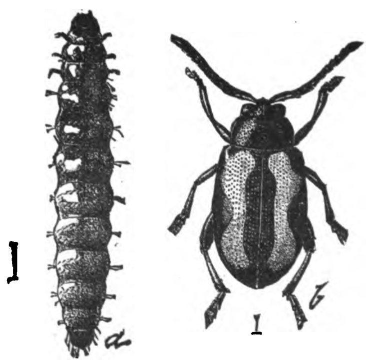


FIG. 7.—Striped Flea-beetle (*Phyllotreta vittata*): *a*, larva; *b*, beetle. [After Riley.]

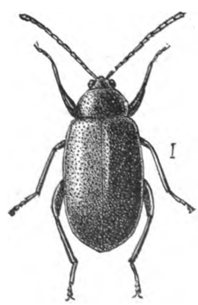


FIG. 8.—*Phyllotreta albionica*. [After Riley.]

The remedies suggested for *tæniata* will also apply to them, should they show a tendency to forsake their more natural food-plants, the various species of Amarantus and Chenopodium, for the beet, or if they come in greater number than usual.

BLISTER-BEETLES.

Quite prominent among the insects that destroy the beet here in the west are several species of moderately large soft-bodied beetles that are popularly known as blister-beetles. Four of these insects are shown in Figs. 9 to 12. As a rule they are quite partial in their food habits to the various kinds of plants belonging to the pulse family (*Leguminosæ*). Nevertheless a number of them have the habit of forsaking these for a large variety of other plants, and especially do they appear to relish garden plants.

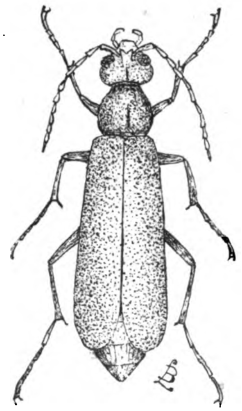


FIG. 9.—The One-colored Blister-beetle (*Macrobasis unicolor*). [Original.]

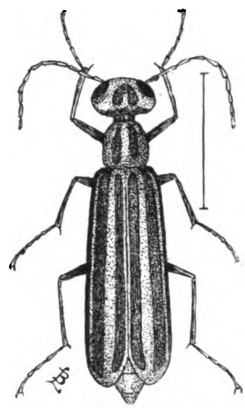


FIG. 10.—The Striped Blister-beetle (*Epicauta vittata*). [Original.]

Like other insects that occur over a rather wide scope of country, and that must necessarily be subjected to great variations of climate, altitude, and abundance or lack of the proper food supply during their period of development, these insects vary greatly in size as well as in color among the different individuals of the same species. Some of them being fully double the size of others.

As a rule, these blister-beetles are gregarious in their habits; and feed in company—sometimes by the thousands. When they gather upon any particular plant or plants they are not long in finishing such portions of it as they can devour. Juicy plants are special favorites of theirs at times, while at other times these are passed by and they seem to prefer just the opposite qualities in their food-plants—just as they are in their comings and goings, so they are in the selection of what they subsist upon as mature insects. They come and go mysteriously, sometimes only as a few stragglers, but more frequently in large swarms. One year they prefer one food-plant, and another year another; so that they will include most of our common plants in their bill of fare inside of a dozen years.

While these insects are both interesting and somewhat of a mystery to us as beetles, they are much more so in their preparatory stages. In treating our common gray species (*Epicauta cinerea*) as a tree defoliator, some space was devoted to in the discussion of its early life-history along with that of other species. Since we will always be more or less troubled by these insects as beet pests I will repeat what I wrote there.*

* Bulletin No. 14 of the Agricultural Experiment Station of Nebraska, pp. 112-114.

"These blister-beetles are among our most interesting forms of insect life, both as regards their life-histories and their economic importance; and it is quite difficult for us to decide whether their existence is really more of a benefit than a detriment to us, or *vice versa*. They appear during the months of June and July, and are both diurnal and nocturnal in their habits. Prof. C. V. Riley, who has been our most energetic American entomologist in working out the life-histories of insects of economic importance, published an account of the life-histories of the present and two other species of the same genus, on pages 297 to 302 of the First Report of the United States Entomological Commission. In that work he shows how the eggs are laid, hatch, and the young larvæ, which at first are very active, search for locust or grasshopper eggs upon which they feed. The life-history of these little triungulins, as they are called, is an interesting one, as portrayed by that author, but not more so than are the succeeding stages through which the same insect must pass before it can issue into the world as a full-grown blister-beetle. Were it not for the lack of space I would quote the author's paper entire. Those who would like to read the account for information can do so by referring to the above named report. In writing the report that I did for the United States Entomological Commission during the summers of 1880–1 in the northwest the following language was used: *

"'Until quite recently the larval habits of our various blister-beetles were but little understood. Since the researches of the commission, however, the preparatory stages of many insects which had hitherto been shrouded in mystery have been ascertained for the first time. Among these were those of quite a number of *Meloidæ*. It has been ascertained that they feed upon the eggs of the locusts, and especially those of *C. spretus* (the Migratory Locust). This, then, accounts for the great numbers of these insects that are found in all the leading locust areas of the west and northwest, especially in the latter district. Riley has shown in the report for 1878 and 1879 † the peculiar and interesting feature possessed by the young of some of these insects, of protracting development of one, two, or even more, years, thereby supplying a new means for the continuation of the species that is dependent upon the uncertainties for its continuation among the living.

"'I have noticed a great number of species of these insects both in Montana and Colorado. In Montana they were mostly partial to the *Leguminosæ-Lupinus, Astragalus*, etc.—some of which, in certain localities, were covered with these beetles, and denuded of their foliage, thus furnishing an example of an insect that in its preparatory stages is parasitic on another, and that after maturing lives upon a plant not eaten by the insect on which it was a parasite. In this way, then, the parasitic beetle is not only insured of perpetuating its kind through its capability of lying dormant in its imperfect stages for an indefinite time if the necessary amount of food is absent, but also through its choice of food, in its perfect state, since it lives upon that which the locust discards.'"

REMEDIES.

Considering the usefulness of these insects in their larval stage, and their erratic nature as beetles, it is a question in my mind whether or not it would be a wise

* Report United States Entomological Commission, Vol. III, p. 41. [1883.]

† Report United States Entomological Commission, Vol. II, p. 260; also American Entomologist, Vol. III, p. 196.

thing for us to be too hasty in their destruction. Even should they appear in large numbers and direct their attention to our beets, would it not be the wisest plan to rather drive them away than to kill them? They are very prolific breeders, it is true, and a very few of the beetles will furnish enough eggs for a vast army of the beneficial larvæ. If we have just had a "grasshopper year," or there is a probability of our having one, my advice would be to spare as many of the beetles as possible, at least until after the majority of their eggs had been deposited. The numbers of these beetles is regulated by the amount of food available for the larvæ and not that of the mature insects. Neither birds nor domestic fowls relish them; nor is it a safe plan for persons with soft or tender hands to gather and crush the beetles between their fingers, for, like the "Spanish Fly," these insects are also "blister" makers when handled. If it becomes absolutely necessary that some remedy be applied in order to save the beets from destruction, and the insects cannot be driven away by repeatedly beating them off, they can be readily collected in pans or other receptacles containing a little kerosene or hot water. The plants can also be sprayed with either London Purple or Paris Green in the proportion of four ounces to the barrel of water.

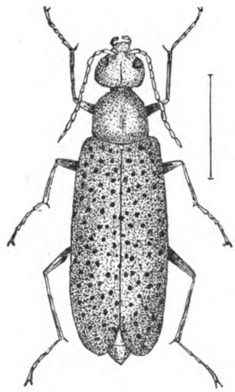


FIG. 11.—The Spotted Blister-beetle (*Epicauta maculata*). [Original.]

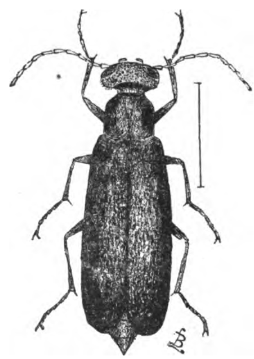


FIG. 12.—The Black Blister-beetle (*Epicauta pennsylvanica*). [Original.]

Thus far, in our studies of beet insects, seven different species of these blister-beetles have been taken on that plant. Of these, Fig. 12 represents the Black Blister-beetle (*Epicauta pennsylvanica*), which is always common on blossoms of the golden rod in late summer and fall. It also is a very frequent enemy of the Tumble and Pig weeds in our fields and gardens. Fig. 11 represents the Spotted Blister-beetle, which is ash-gray and mottled with black. This insect is very partial to the Lamb's-Quarter or White Pig-weed (*Chenopodium album*), and also to the different species of Atriplex. It also occurs on the Grease-wood of the western plains. Fig. 9, the One-colored Blister-beetle (*Macrobasis unicolor*), also a clover insect, is very common in eastern Nebraska. It is grayish-brown in color. Fig. 10 represents what is perhaps our most injurious species of these insects, viz., the Striped Blister-beetle, which is a yellowish-brown and black. This one is a very destructive potato and tomato pest, and it also feeds quite greedily upon all of the Nightshade family. Besides these, it has been found to attack the Arrow-leaved water lily

(*Arum undulata*) here in Nebraska, and sometimes entirely devours the leaf and stem. The Gray Blister-beetle (*Epicauta cinerea*) also occurs upon the beet, but less frequently than the ones just mentioned.

TRUE BUGS.

Some of the true "bugs," *i. e.*, representatives of the order Hemiptera, to which belong the Squash-bug, Bed-bug, and others, are among the most noted enemies of the sugar and other varieties of beets. There are at least a half dozen different kinds of these bugs that have turned their attentions from the weeds upon which they feed to the more promising beet as a steady diet. Four of these bugs are shown in figures 13 to 16 inclusive. All three of these have at various times been mistaken for the much dreaded Chinch-bug, and perhaps for good reasons, too. Like the insect for which they have been mistaken, they very frequently become very numerous and congregate upon various plants in the field and garden. The various weeds have been and now are their characteristic food-plants; but the beet is so closely related to some of these that it is equally attacked by them.

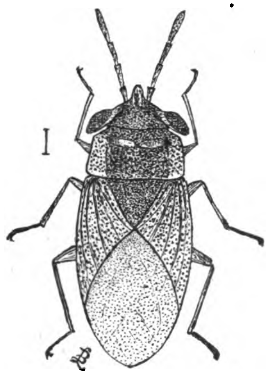


FIG. 13.—Large-eyed Ground-bug (*Geocoris bullata*), enlarged. [Original.]

FIG. 14.—Gray Plant-bug (*Piesma cinerea*). [After Riley.]

The one shown in Fig. 13, the Purslane or Large-eyed Ground-bug, as we will call it, is known as *Geocoris bullata* to the entomologist. It is a very common insect in all parts of the region to the eastward of the Rocky mountains and west of the Missouri river. It is especially fond of the Purslane weed, but is by no means confined to this plant for food, since it also occurs on Amarantus, Polygonum, Chenopodium, the "stink" grass, and several other weeds; besides these it frequently attacks grape vines and small trees in early spring where the weeds are slow in starting. The *Piesma cinerea*, shown in Fig. 14, has similar food habits but is more partial to the different species of *Amarantus* (Pig-weeds, Tumble-weeds, etc.) than to the Polygonums and grasses. In fact it seldom touches these latter,

nor does it often attack trees, vines, or shrubs. When the beet is in question, they meet on equal terms, A third bug is illustrated at Fig. 16, and is known as

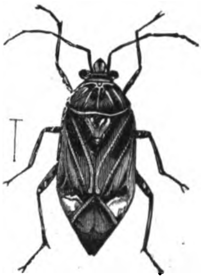


FIG. 15.—Tarnish Plant-bug (*Lygus pratensis*). [After Riley.]

FIG. 16.—False Chinch-bug (*Nysius angustatus*); mature insect, enlarged. [After Riley.]

Nysius angustatus. This last named bug is more partial to the various cruciferous plants, but also feeds upon the beet.

The ordinary Chinch-bug has also been taken quite often in beet patches, and upon the tops, which they were claimed to have injured.

REMEDIES.

The most practical and lasting remedy against these bugs is the destruction of their natural food-plants, the different kinds of weeds referred to above. By doing this the insects will never have an opportunity of increasing in injurious numbers. The weeds that are allowed to grow on neglected fields after midsummer are the means of increasing all three of these species. Climate, too, has much influence on these insects; for with them, as with the Chinch-bug, wet weather is a disaster, while dry weather is a boon.

When present in numbers the kerosene emulsion, so often recommended as a remedy against certain insects, is moderately successful.

LEAF-HOPPERS.

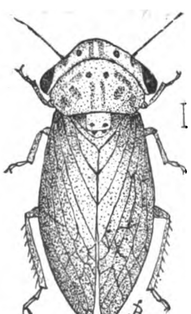


FIG. 17.—Garden Leaf-hopper (*Agalia siccifolia*) — enlarged. [Original.]

Next in abundance, and perhaps in destructiveness, are several species of small insects with sucking mouth-parts. These are to be distinguished from the preceding by their structure and by their powers of jumping or hopping. These little insects are at once recognized by reference to Fig. 17, which represents our commonest leaf-hopper in the garden, where it devotes itself to the various "Pig-weeds" and "Tumble-weeds," which it infests. Its name is *Agalia siccifolia*. While it likes the above named weeds, it also seems to think that the sugar beet is worthy of being added to its bill of fare. This insect is gray, plainly mottled with light brown as shown in the illustration. It is about one-tenth of an inch in length, or as long as the line shown at the side of the figure. Six different ones of these leaf-hoppers were taken on the beet during the past summer.

REMEDY.

When very numerous these leaf-hoppers can be treated with kerosene emulsion. The London purple and Paris green remedies will not reach them, since they take their nourishment from the inside of the leaf through their beaks.

CUT-WORMS.

It is needless for me to tell the farmers of Nebraska that cut-worms are among our most dreaded insect pests, for everybody who has tried to raise corn, or garden crops of any description, for several years in succession has had experiences of his

FIG. 18.—Dark-sided Cut-worm (*Agrotis messoria*): *a*, larva; *b*, moth. [After Riley.]

own concerning their powers of destruction. Several of these cut-worms are shown along with the moths of which they are the young in Figs. 18 to 21.

Some of the different kinds of these "worms" were caught in the very act of cutting off small beet plants during the months of May and June at various points whiitn the state.

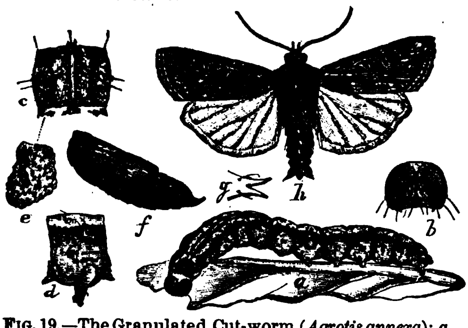


FIG. 19.—The Granulated Cut-worm (*Agrotis annexa*): *a*, larva; *f*, pupa; *h*, moth. [After Riley.]

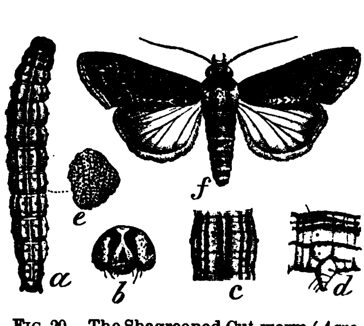


FIG. 20.—The Shagreened Cut-worm (*Agrotis malefida*); *a*, larva; *f*, moth. [After Riley.]

It is not necessary for me to state that the name "cut-worm" embraces the numerous species of caterpillars that have the habit of concealing themselves during the day-time, either beneath some object lying on the ground, or by directly burying themselves just below the surface, and coming forth after night to feed upon various kinds of vegetation. Many of them confine their attacks to garden products and other low succulent plants, but others are known to climb up the trunks of trees, grape vines, and a variety of the taller kinds of vegetation belonging to garden, vineyard, and orchard, where they cause great havoc by eating the buds and tender leaves in early spring. Cut-worms are the young of a certain group of "Owlet" moths, which are also nocturnal in their hab-

FIG. 21.—The W-marked Cut-worm (*Agrotis clandestina*)—larva. [After Riley.]

its. Both the larvæ and mature insects are, as a rule, inconspicuous in color, being usually dull gray, brown, or black, or have these colors combined.

There are upward of three hundred distinct species of cut-worms found within the limits of the United States; and perhaps fully one-third that number occur within our state. While the term is a general one for the caterpillars of moths belonging to several allied genera, we will confine ourselves in the present article to the genus *Agrotis*—a name that signifies rustic, or belonging to the fields—a sort of "granger" as it were! It is the members of this particular genus that are most familiar in Nebraska, and are to be dreaded on account of their depredations on crops of all kinds.

These cut-worms are moderately large, fleshy worms tapering gently towards both ends. When full grown they average from one and one-fourth to one and one-half inches in length, are dull yellowish-white or gray, sometimes inclined to greenish, and clouded and striped or variously marked with dull black or smoky brown; sometimes, though rarely, with deep black and pure white. One of these worms (*Agrotis clandestina*) is figured herewith (Fig. 21), the illustration showing it as curled, a position taken by them when disturbed. This species is about an average in size—some species being larger and others smaller than this.

REMEDIES.

It is a rather a difficult matter to name any single or even two or three remedies that will apply to all cut-worm depredations. Before the various species had been separately studied, it was and even now is supposed by many that what is true of one is also true of all species of cut-worms. The different kinds appear at different seasons, and work in different ways, hence must be fought in various ways.

In the garden many of the worms can be taken by supplying artificial hiding places for them in the form of blocks, chips, or boards, which can be examined each morning and the worms crushed. Digging about hills of corn, stalks of cabbage, and tomatoes, and other plants showing recent disturbance, will usually result in the finding of the culprit. Cones of tar-paper set about plants will act as safeguards against their attacks, provided the paper projects an inch above ground. Salt is also said to be repulsive to the worms. This latter mode of fighting injurious insects is not to be too highly recommended, since salt is also more or less detrimental to the growth of many kinds of vegetation.

The very best remedy that has thus far been suggested and tried against cut-worms is the use of poisonous grasses, cabbage leaves, or clover. This is done by taking these substances and tying them into loose bunches and then sprinkling them with a solution of Paris green or London purple, say a tablespoonful to a bucket of water. Then in the evening scatter these poisoned baits over the field between the rows of beets, cabbage, etc. The worms will be attracted to them, eat and die. These baits should be renewed several times at intervals of two to four days, according to the state of the weather and the abundance of the worms.

FIG. 22.—Tachina or Flesh Fly.

All of these cut-worms are attacked by several kinds of parasites, both hymenopterous and dipterous. They are also devoured by a number of predaceous beetles, while birds of many kinds are especially fond of them. One of these dipterous parasites is shown in Fig. 22.

The various insects figured and described in the foregoing page are all leaf eaters, and feed wholly upon the foliage of the beets, and other plants attacked, or upon those portions above ground. There are also a few kinds that have been observed to attack the root, or that portion in the ground. Among these certain species known as

WIRE-WORMS.

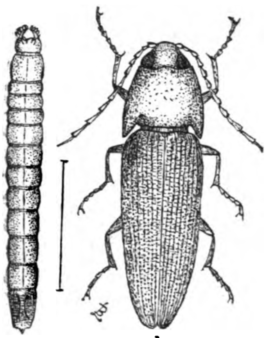


FIG. 23.—The common Snapping-beetle (*Melanotus communis*): *a*, larva; *b*, beetle. [Original.]

are quite prominent in some portions of the state, where they occasionally do considerable injury to the beet as well as a number of other cultivated and wild plants. These "wire-worms" are the young of the various kinds of "Click-beetles" or "Snapping-beetles" so common everywhere, and that are perfectly familiar to every boy. One of these "snapping-beetles" is shown in the accompanying illustration—(Fig. 23, *b*). The larva or "worm" on the right hand side represents one of the "wire-worms," and probably of the same species as the beetle (*Melanotus communis*). These wire-worms are rather hard, smooth, cylindrical larvæ of a light brownish-yellow or straw-color. They live, as a rule, in the ground, where they feed upon the roots of various plants. In the case of the beet, they sometimes bore into the root, or they eat away the small fibrous rootlets, and in that manner cause the plant to shrivel up and die. Wire-worms are said to be rather long-lived, some of them remaining in that stage for several years.

REMEDIES.

As yet no satisfactory remedy has been discovered for the destruction of wire-worms on a large scale. But, since they seem to be most abundant on new land, or on such fields as have been in grasses for a few years, they will never be among the species of insects that do the greatest amount of injury to the beet crop.

CULTIVATION.

Soil, climate, and cultivation are factors of equal importance in the culture of the sugar beet.

In respect to the first two, nature has here left but little to be desired. That the beet grower may be enabled to make the condition that is left wholly with him equal to the others in value, the following pages, giving the results of the best experience of European farmers, have been prepared by Mr. H. E. L. Horton, of this station, who has had considerable experience in beet growing and with beet growers, both in this country and in Europe.

PRELIMINARY.

Tillage gives a porous soil, which allows of circulation of air and moisture, two very important factors, and secures to the particles of plant food an equal distribution through the layer of soil worked.

On every hand we see the utmost care taken in preparing a homogeneous mellow seed-bed when a crop of importance is to be raised. Air must come to the seed and plant, else it will rot and die; moisture and warmth it must have, and then as it starts growing the soil must be mellow and present no obstacle to the rootlets.

The natural tendency of the root is to grow downward, and it does not bore its way, but pushes through the interstices between the earth particles. The beet has a large root system, and when it is well developed it is a safeguard against drought.

Who does not know that trees and plants tend to a symmetrical form in their growth, and how every obstacle interferes and distorts? This is equally true with roots.

Tillage comes in and reduces to a minimum the disturbing influences.

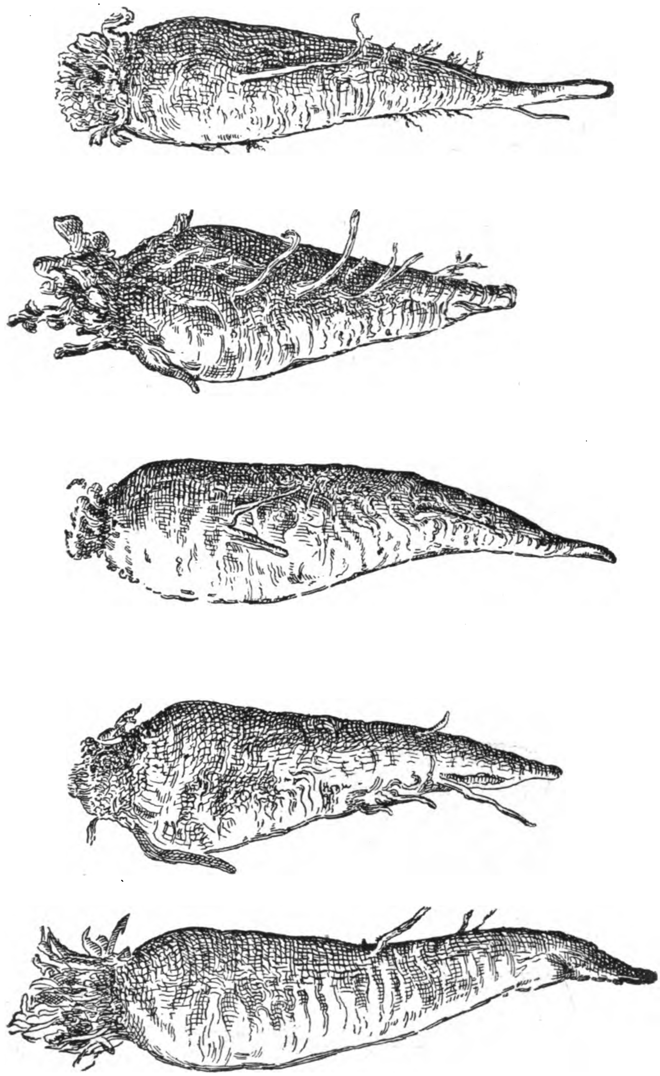
From the handling of thousands of beets at Grand Island, I have been able to identify stunted and many legged beets with a shallow and poor tillage.

The depth of the homogeneous mellow soil-bed is of great importance, for the deeper it is the longer and better will the roots be, and the easier will they take moisture and plant food from the soil, and more than this, the root will have a symmetrical form.

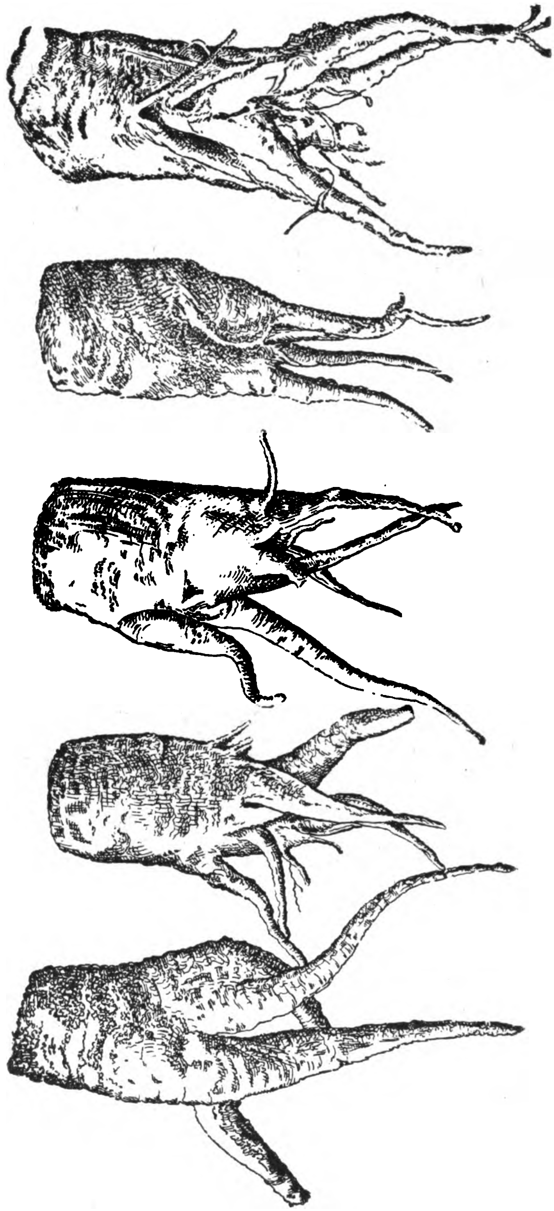
And we must not stop content with a good seed-bed when we desire good beets, but we must follow up the subsequent culture assiduously.

To make the point clearer than is possible with words we beg to call especial attention to the accompanying plates.

The first plate represents beets of white Silesian variety grown on good soil and with proper care and plenty of cultivation. The beets are of good form and show good characteristics, and would be sought after by factory.

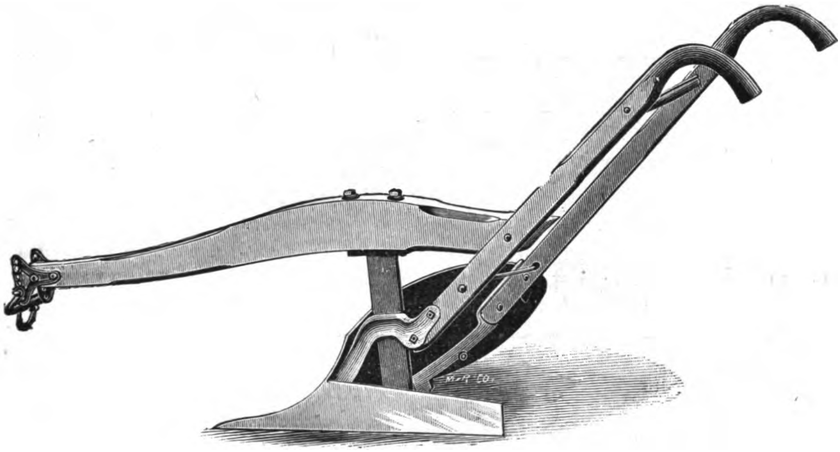


The second plate represents beets of white Silesian variety grown on same soil from same kind of seed, but without proper care and with insufficient cultivation. They have no good characteristics, and are dreaded by factory, and are only fit for forage purposes.

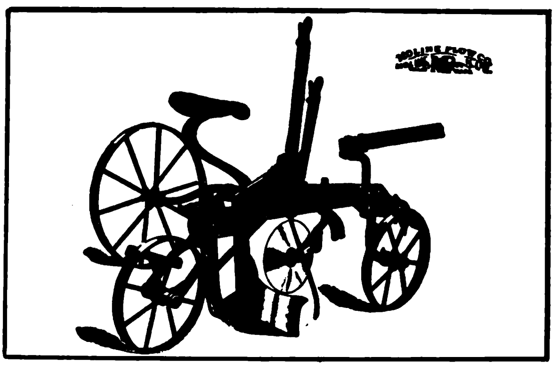


SURFACE PLOWING.

The deepening and stirring up of the soil is to be accomplished little by little, and only in case where the subsoil and surface soil differ very slightly in character is the deepening and stirring to be done at one time.



The surface plowing should be to a depth of from six to eight inches, and is to precede the work with the subsoil plow. Many Nebraska farmers plow too shallow, some instances of 2 to 3 inches being observed.



SUBSOIL PLOWING.

The stirring up of the subsoil is done by means of so-called subsoil plow, which stirs the subsoil without mixing it with the surface soil. Subsoiling follows surface plowing or may be done at same time with surface plowing by subsoil attachment to ordinary plow, with line of draught properly adjusted.

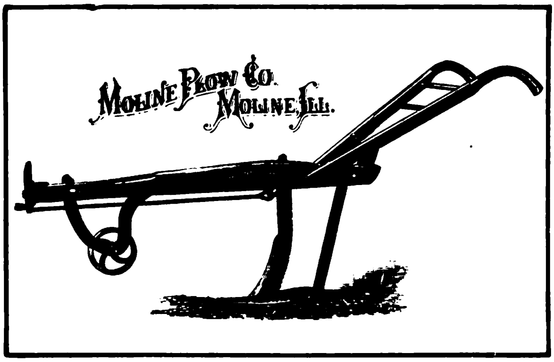
Cuts were furnished through kindness of Fuller & Johnson Manufacturing Company, Madison, Wisconsin, and Moline Plow Company, Moline, Illinois.

The value of subsoil plowing is too well known to need any discussion, but it will be interesting to have an example of its efficiency. In the instance of a Mr. Wilson, cited by Professor Storer, the difference in yield of two-tiled drained fields plowed 8 inches and 18 inches are given:

	TURNIPS.		POTATOES.		BARLEY.	
	Tons.	*Cwt.*	*Tons.*	*Cwt.*	*Bush.*	*Cwt. Straw.*
Plowed to 8 inches	20	7	6	14¼	60	28
Plowed to 18 inches	26	17	7	9½	70	36½
Difference	6	10	......	15¼	10	8½

In instances on German beet farms where the stirring of soil is to the depth of sixteen inches, an increase of two to four tons was obtained.

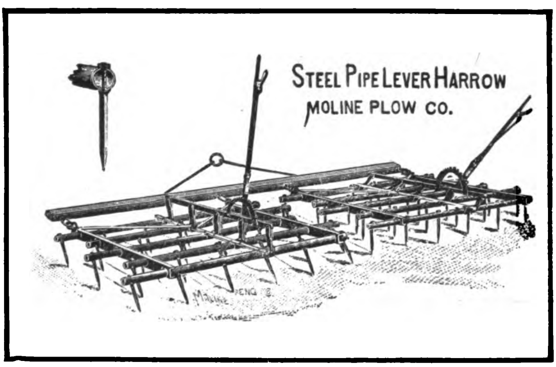
The farmer must be very careful in use of subsoil plow, for there is great risk of puddling when the plow is used at an improper time. It may be that the surface soil is ready to plow to good advantage, while the subsoil is too wet.



When to use the subsoil plow is a vexed question. The most natural time would seem to be the early autumn, but in this the farmer must be guided by his own judgment and experience.

HARROWING.

The rough furrows turned up in the autumn have weathered during the winter



months and in the following spring the process of harrowing reduces the lumps and prepares a smooth seed-bed. The time to harrow is when the soil is so far dried that it crumbles readily, and when this point is reached the harrowing should be proceeded with to the leaving undone of all other farm work, if necessary, for the time during which the soil harrows well is quickly over. Has the soil dried, then a large amount of work will be necessary to bring it into any kind of condition and it will never be what it could have been had the farmer watched carefully for the proper moment.

The angle iron or steel pipe lever harrow of Moline Plow Company will answer the purpose of the German zigzag and rhomboidal harrows even better than they.

ROLLING.

Immediately following the last rolling the seed is to be planted. The purpose of rolling is to bring moisture from the lower soil layers to the surface and aid in the germination of the seed. When we pat down down the earth over a hill of corn we have in view the same end.

Rolling is the common European practice and should become more general in this country. Care should be taken, however, that the ground be not rolled too hard.

F. H. King, in the Seventh Annual Report of the Wisconsin Agricultural Experiment Station, has recently brought the subject before the farmers of his state. He found that for oats, 41 per cent and 11 per cent; for peas, 35.7 per cent; for barley, 10.3 per cent, greater germination on rolled than unrolled soil.

PLANTING.

There are two methods of planting—in hills as with corn, or continuous drilling as with wheat. In case planting in hills is decided upon, then the drill used must have a plate adapted to the purpose. If continuous drilling is decided upon, then a drill like that used in drilling wheat and oats is to be used.

If the first method is used, then the beets are *planted* in hills; if the second is the one used, then the hills are to be made by cutting out of the continuous row —(cut away the beets in the row, leaving small bunches every four, six, eight, or ten inches as the soil is rich or poor).

Where small plots are cultivated, a hand hoe with a sharp blade about five or six inches wide is to be used in cutting out the extra beet plants. Where large plots are cultivated, a horse hoe with cutting knives properly adjusted is run across the rows at right angles and hills made in this way.

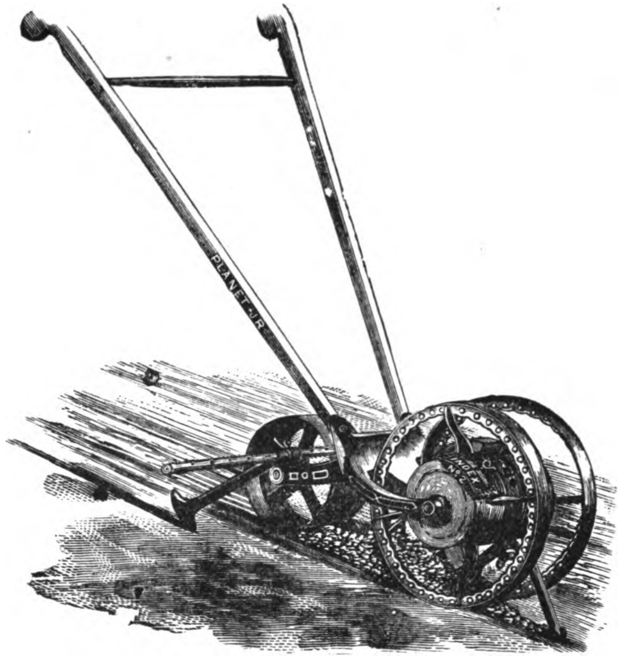
Which of the two methods of planting will be used by the beet growers will depend on circumstances. Both methods have advantages as well as disadvantages and we will advise on this subject in a later bulletin.

By continuous drilling the danger from crust formation is very much lessened, for where a large number of plants come through the ground at one time the crust is more easily broken than by single plants.

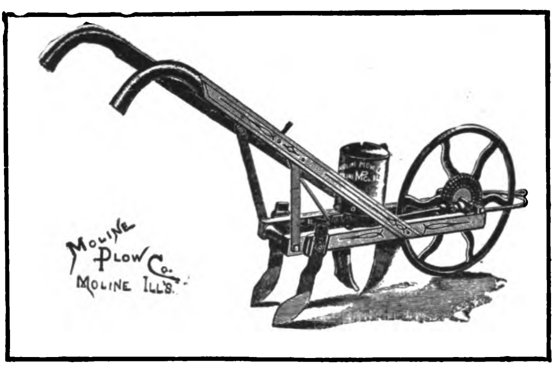
When continuous drilling is the method it is easier to have the plants in the right places, which is a weighty consideration.

The time for thinning out must be more carefully looked after in this method, for the plants are so near together that they readily suffer from delay.

The amount of seed used per acre in the first method averages from twenty to twenty-five pounds, in the other method from thirty to thirty-five pounds. One must not be sparing in the use of seed, for a good stand is of the greatest importance.



A word regarding the seed drills to be had in the market. Last year the Planet Jr. No. 2, manufactured by S. L. Allen & Co., of Philadelphia, gave satisfaction, and it can be recommended for planting small plots. Where large plots are to be planted, then we must use the large horse drill which drills four rows at one time.



At present we are not in a position to recommend any of the large horse drills, but will do so in a later bulletin.

When we come to planting we have another very important subject to speak about. The yield and quality of the harvest depends on the time of planting, the distance between the rows and hills, and the depth of planting.

TIME OF PLANTING.

Desprez gives the following as the result of his experience as regards time of planting in a year having a late spring:

TIME OF PLANTING.	YIELD PER ACRE.		PERCENTAGE SUGAR.	SUGAR PER ACRE.
	Tons.	*Lbs.*		*Lbs.*
May 6	22	686	12.90	5764
May 21	20	1393	12.50	5174

We can see at a glance what a difference of two weeks made in the final harvest.

That we may have the subject before us in a series of carefully conducted experiments we can do no better than to quote the result of Marek made in east Russia:

DATE OF PLANTING.	Weight of Beet in Grams.	Polarization of the Juice.	Stammer's "Worth-number."
1879.			
May 8	612.8	**12.42**	10.7
May 15	655.2	12.21	10.4
May 22	**658.4**	11.10	8.7
May 29	560.8	11.68	9.7
June 5	384.8	11.63	9.6
June 12	268.6	12.45	10.9
June 19	248.6	12.49	10 4
June 29	224.0	10.54	8.3
1880.			
April 15	359	10.86	9.3
April 25	524	11.61	9.9
May 5	530	11.74	9.9
May 10	461	12.58	11.1
May 25	**530**	12.79	11.1
June 5	284	**13.30**	11.3
June 15	213	12.64	10.7
June 25	196	12.49	10.1
1881.			
April 27	259	13.32	11.6
May 5	**501**	**14.41**	12.1
May 15	238	13.89	11.1
May 25	291	13.94	12.6
June 5	308	12.53	9.5
June 15	262	12.04	9.6
June 25	78	12.62	9.7

Inspection of this table shows that the largest yields were obtained from seeds planted at the beginning of the middle springtime, and it is noticeable how the yield from seed planted earlier and later than this time falls of.

It has been often observed that the early planted beets are the best; they get a

start which helps them in dry weather. Frosts are less to be feared than too late planting.

We are not in position to give good advice applicable to the Nebraska season for planting, but we can say, in general, that the time of planting may be early (middle to end of April), medium early (beginning of May to June), and late (first to middle of June). Planting in the middle springtime shows the best and is to be recommended.

It is to be borne in mind that the seed is to be planted in soil warm enough to allow of plants coming through in from six to eight days. Cold, wet soils will require twelve to fourteen days, and should the plants not show well in this time, plowing under is to be advised.

There is another factor in this question, namely, when we have late ripe beets or early ripe beets. This must be taken into consideration.

DEPTH OF PLANTING SEED.

The depth of planting should be as shallow as possible, because the danger from insufficient covering is less than from having seed too deep. As result of careful experiments ⅜ inch gives most complete germination; but long practice gives ¾ to 1¼ inches as being the best depth, and we can recommend this depth. It will be of interest and very instructive to give a set of experiments showing the influence of depth on germination and consequent good stand.

Seed planted	⅜ in. deep	1¼ in. deep	2 in. deep	3⅛ in. deep	4¾ in. deep
a. No. of plants coming up	59	44	30	4	0
b. No. of plants coming up	49	40	23	2	1

At this point a few words must be said on the necessity of a porous soil free from any crust.

When a crust is formed after planting it is to be broken by using a ringed roller or a light harrow with teeth set for smoothing. The angle iron or steel pipe lever harrow of Moline Plow Company will answer this purpose. In using the harrow it is advisable to cross-harrow, and with proper kind of implement no one need fear disturbing the seed. By such a breaking of the surface the air comes in contact with the seed and assists the germination and growth materially.

If at this point, having worked with all care, the plants do not come up, or coming up do poorly, then the seed in the ground is to be examined for insects, and if they have caused the mischief new seed is to be planted. The ground is to be prepared for the second planting by breaking to a medium depth, harrowing well and rolling.

To show the injurious effect of crust on the germination of seed, and of course the subsequent stand, the following experiments will be of use:

Condition of the Soil.	Number of days before first plant appeared.	Number of Plants After		
		Eight days.	Twelve days.	Sixteen days.
Surface soil covered with coating of mud 3-16 in. deep	6	12	16	19
Surface soil covered with coating of clay 3-16 in. deep	6	11	15	17
Surface of soil stirred to depth of 1¾ in. every three days	4.6	20	26	27

DISTANCE BETWEEN ROWS AND HILLS.

It is customary to have the rows sixteen to eighteen inches apart, and from what we know at present, increasing this distance is to be discouraged. On the distance between hills or plants depends a great deal, for we have it in our power to influence the *quantity* and *quality* of the harvest at will. Where the soil is rich the distance between the plants may be placed at seven inches, which will give twelve plants to the square meter (practically square yard); where the soil is poor, then ten inches between the beets is to be advised, which will give ten plants to the square meter.

To see just what influence the distance of planting has on the harvest, we can do no better than quote Ladureau, and also Marek.

Ladureau planted plots with distance between the rows 16½ inches, and the distance between the beets 6 8-10 in., 11 13-16 in., 13 6-8 in., 15¾ in., 19 11-16 in., and with following results:

Distance between beets	6 8-10 in.	11 13-16 in.	13 6-8 in.	15¾ in.	19 11-16 in.
Yield per acre	T. 31 Cwt. 436	T. 30 Cwt. 1098	T. 31 Cwt. 293	T. 27 Cwt. 1934	T. 23 Cwt. 358
Per cent sugar in beet	11.62	11.21	10.48	10.61	8.97
Per cent water in beet	85.55	85.85	86.74	86.44	87.28

The largest yield and largest sugar content is obtained when distance between beets approximates ten inches, and decreases steadily as we increase the distance.

The experiments of Marek shows very clearly how the sugar content and purity is influenced by the distance between the beets, and as the farmer is paid for his beets according to the sugar content and purity, a study of these figures will be very useful.

When the space given beet is	1100 qcm.	1000 qcm.	900 qcm.	800 qcm.	700 qcm.	600 qcm.	500 qcm.
Percentage sugar in beet	7.543	7.792	7.424	8.990	9.888	9.284	11.442
Non-sugar in beet (Indication of purity.)	4.028	3.779	3.909	3.533	3.112	3.239	2.748

Where the distance between the beets is only a few inches, as represented in column eight, then the sugar content is greatest and the non-sugar the lowest; when the distance between the beets is considerable, as in column two, then the sugar content is lowest and the non-sugar highest.

The farmer must plan his work so he can plant the seed the day following the preparation of the seed-bed. Preparing the seed-bed, and then delaying the planting three or four days, or even a week, is not to be thought of.

THINNING OUT.

There are two methods of planting—drilling continuously as with wheat, or in hills as in case of corn. In either case we have finally a bunch of four or five small plants which must be thinned out, leaving one in the hill.

Thinning out is usually the work of boys from ten to sixteen years of age, who can stand the long continued stooping better than a man.

This work must proceed using both hands, one hand (the left one) holding the

best appearing plant, while the right hand by a slow, sideward and upward movement removes the less thrifty appearing and throws them in a pile between the rows, and in no case on the small beet plants. Before releasing the plant held by the left hand, the right hand is to be used in gathering and pressing the soil around it. The thinning out follows the second hoeing, for at this point the beet plants begin to grow very strongly. In general early thinning is the best, too late thinning out making difference of from two to three and one-half tons per acre in favor of the early thinned plots.

Thinning out at too early stage is to be avoided, for added to the mechanical difficulty of thinning it is also difficult to make sure of the best plant to leave in the hill. Experiments have been made to determine the best time for thinning out, and if a beet grower will examine the following table carefully he can form a good idea for himself.

EXPERIMENTS TO DETERMINE THE BEST TIME TO "THIN OUT."

J. Sekerka.—Wiener Landw. Zeit. (1888), No. 5, S. 31.

Six plots were selected side by side. The soil was the same, the amount of fertilizer each plot received was the same, and the seed sown at same time and in same manner. The plots were planted April 22, 1887, and a strong stand obtained. Beets harvested September 15. *The thinning out occurred at intervals of one week.*

Number of the Plot.	Date of "Thinning Out."	Date of Rainfall after the "Thinning Out."		Yield Per Acre.		The Increase in yield of Each Plot over VI.		Remarks.
		Date.	Amount of Rain in mm.					
				T.	*Lbs.*	*T.*	*Lbs.*	
I	May 24	May 25	19.7	14	756	4	741	Cotyledons well developed, but no leaves.
II	May 31	June 3	15.2	13	1846	3	1831	*First pair of leaves well developed.*
III	June 6	June 7	4.8	13	1061	3	1046	*Second pair of leaves appear.*
IV	June 13	June 14	0.6	13	544	3	529	The two pair of leaves well developed.
V	June 20	June 21	6.1	12	671	2	656	The third pair of leaves well developed.
VI	June 27	June 28	8.3	10	15	....		The third and fourth pair of leaves well developed.

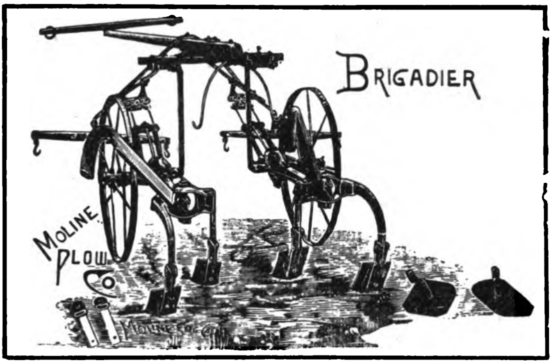
It is very clear from this table that one week makes a considerable difference in the final crop. On plot I the largest yield was obtained, but no leaves had appeared when thinning out occurred. The plots II and III are to be taken as rule giving, because just as soon as a plant has two well developed leaves and is otherwise healthy, thinning out can take place without fear.

HOEING.

As soon as the plants are up then must the hoeing begin, and at first very lightly, using a narrow-bladed sharp hoe, by which the surface only may be stirred. The following and later hoeings are to be made deep, and stir the soil well, and a wide blade hoe is to be used.

Hoeing has been rendered less difficult and less expensive by the introduction of

horse hoes, but the use of the horse hoe is to be supplemented in the field by the use of the hand hoe. Great care must be exercised in using the horse hoe, for if the setting up and use be not carefully looked to the weeds will not be extirpated and whole rows of beets will be cut down. What is said of horse hoes is particularly true of European hoes, for they are not arranged for "dodging." The principle embodied in the "Dandy Cultivator" made by the Moline Plow Company can without doubt be adapted to the building of a perfect horse hoe.



When is the time to hoe? When the soil is dry and crumbles readily. The well known beet grower, Fuhling, says: "The hoeing must take place when a crust has been formed and no weeds to be seen, for, when weeds show themselves there is no crust present. When insects threaten damage, then must the soil also be freed from weeds and well stirred."

Hoeing the beet cannot be too highly recommended, for, as they say in Germany, "sugar is hoed into beets." Knauer gives a short table which is to the point and shows what hoeing will do. A plot hoed

Once gave per acre 7 tons 199 pounds beets.
Twice gave per acre 8 tons 279 pounds beets.
Three times gave per acre 10 tons 1,737 pounds beets.
Four times gave per acre 12 tons 1,103 pounds beets.
Five times gave per acre 13 tons 294 pounds beets.
Five times hoeing has nearly *doubled the yield* per acre.

HILLING UP.

Under no circumstance is hilling up to be practiced on dry, warm soils, for it can only work harm. Hilling up is to benefit cold and wet soils. It is closely connected with hoeing, and follows the last one, and consists in drawing the soil up and around the beet plant.

Hilling up prevents puddling of the soil around the beet, and insures a porous condition. Water evaporates from surface hilled up much quicker than from a flat surface, as is the case in flat culture, for the surface exposed is very much greater.

Kraus has shown that by hilling up the tendency of the tops to turn green is

greatly reduced, as is also the formation of adventitious stems, which scar and roughen the beet tops so that the tare is very large. It has also been shown by another that hilling up increases the quality and quantity of the harvest.

Hilling up where plots are cultivated can easily be done with a hand hoe; where large plots are cultivated a special plow or cultivator is used to throw the furrow toward the plants.

GENERAL SUGGESTIONS.

Beet growing for sugar-making is a business to be learned largely by personal experience, guided as far as possible by the experience of others who have already made the business a success. It is destined, under ordinary circumstances, to be one of the most important and productive interests of this state. Investigations of this department have already demonstrated that beets of great richness and purity can be grown in all parts of this state. It now remains to determine how great a yield we can ordinarily obtain and at what average cost.

When farmers appreciate fully the fact that a crop requires intensive cultivation, and when they become convinced that such cultivation will pay, either in an increased yield or otherwise, THEN will they strive to reach the conditions required.

Now, in the very beginning, is the time for the farmer to be learning, experimentally, how to reach the best results under the conditions surrounding him. This preliminary practice work will be of more benefit to the future of this industry in the state than will be a dozen factories located now, before the farmers know how best to grow beets or appreciate the direct and indirect benefits to them of beet root production.

In an address given before the State Board of Agriculture, at its last meeting, the director of the station urged upon that body the value of co-operation between them and the Experiment Station in inducing farmers to plant measured plots of beets to keep an accurate account of cost and yield. In accordance with his recommendations the Board of Agriculture set apart a certain sum to be given in premiums for sugar beet growing. A committee was appointed, consisting of two members of the State Board and the director of the Experiment Station, who were instructed to prepare a premium list and devise conditions under which these premiums should be given.*

The questions most frequently asked now by correspondents are in regard to factories, the cost of erecting, and the means of securing them. Many inquirers express the idea that a small factory can be erected for a few thousand dollars and successfully managed on a small capital. But facts show that small factories, as a rule, are not promising. It is safe to estimate cost of factory at from six to eight hundred dollars per ton of capacity, and to place the minimum capacity at 250 to 300 tons of beets per day.

The proper way to bring beet sugar capital and factories into the state is to demonstrate to the world that beets can be grown at a moderate cost and in sufficient quantity, with fairly good sugar percentage. The last item has already been shown to be a fact by the investigations of this department; we hope, during the coming season, to obtain very valuable information in regard to the other items by the means already mentioned. With knowledge on these points, the people will not

*For premium list and conditions reported by the committee, see Appendix II.

be called upon to offer other inducements than that of furnishing the required quanty of beets.

As we have elsewhere said, if every farmer in Nebraska would grow one measured acre of beets and keep an exact expense account with it and an exact account of its yield, the benefit to him in an enlarged experience and knowledge of the business, and the benefit to the state at large and the public generally, in having facts in regard to yield and cost, could not be stated in dollars and cents.

To the farmer who, on first thought, may object to the cost of raising an acre of beets when there was not a factory for extracting sugar within a hundred miles of him, we would say that, leaving out of the question the knowledge and experience gained in raising them, he would find a positive profit coming to him in the value of his beet roots as stock food. Again, he would find an indirect profit in the improvement of his land for other crops by the thorough culture he would have to give his beets. This last statement is based on the assumption that he has cultivated his beets in the most thorough manner.

Mr. E. B. Grant, in his work on beet root sugar, says: "The beet is an enriching and cleaning crop; it requires no fallow; it is the best known forerunner of other crops; it feeds multitudes of stock, and, instead of impoverishing the soil, constantly improves it. In fact, there can be no doubt that the beet crop will be found to be as profitable to the farmer here as it unquestionably has been to the European farmer. The farmers of the west possess many great advantages over those of Europe. They have a virgin soil prodigiously productive, easily cultivated and of low cost, and agricultural machinery with which one man can do the work of a dozen. Probably, notwithstanding the high prices of labor, there is no other country in which an acre of land can be cultivated so cheaply as in the west.

"The culture of the beet involves the necessity of deep plowing, heavy manuring, and thorough weeding. The pulp from which the juice is extracted in the manufacture is an excellent food for cattle; the number of which has been increased in districts devoted to that industry from eight to ten fold since the introduction of beet sugar making. These cattle furnish an immense amount of manure which applied to the deeply plowed and well weeded beet lands enhances their productiveness for the cereals."

As an indication of how the culture of beet root can stimulate other lines of agricultural industry we quote again from the same book:

In 1853, when the emperor and empress of France came to Valenciennes, a triumphal arch was erected with the following inscription:

SUGAR MANUFACTURE.

Napoleon I, Who Created It.	Napoleon III, Who Protected It.
Before the manufacture of beet sugar, the arrondissement of Valenciennes produced 695,750 bushels of wheat and fattened 70 oxen.	Since the manufacture of beet sugar was introduced, the arrondissement of Valenciennes produced 1,157,750 bushels of wheat and fattens 11,500 oxen.

As will be seen from this inscription, beet culture will not supplant but will aid all other farm crops. The Nebraska farmer who engages in the business of raising beets for the factory even, should not neglect in any way his other crops and sho-- look for his best profit in the improvement of his soil and in the increased his grains and grasses.

The Experiment Station stands ready and is anxious to co

farmers' organizations throughout the state, as it has already done with the State Board of Agriculture, in obtaining and demonstrating the facts in regard to the beet sugar industry.

There is no doubt that wherever the beet is cultivated land increases in value, the wages of the workingmen are increased, and general prosperity is promoted.

Prince Napoleon, in his work on the sugar beet,* makes the sugar industry say: "Respect me, for I enrich the soil; I fertilize the land, which without me would remain uncultivated; I employ the hands, which without me would be idle. Finally, I solve one of the greatest problems of modern society, I organize and improve labor."

It must not be lost sight of that the results reported in this bulletin are from high-bred seed and were obtained in spite of new soil and unskilled cultivation. Should these beets be used to produce seed it is altogether probable that in the beets raised we should see a great deterioriation in sugar qualities. We must learn and appreciate the fact that to grow beets, for sugar requires a high grade of agricultural talent. Slovenly farming here cannot be productive. We must have high-class, thoughtful, intensive cultivation. Because, with seed produced abroad under such conditions, we, in our novitiate and with new soils, have for once produced high-grade beets we must not therefore assume that high cultivation is unnecessary. The tendency of all high-bred stock is toward deterioration, and unless kept up by judicious selection and careful cultivation, it will soon revert to its original state. For this reason beet seed production is a special business, and can only be successful in the hands of men who can give much time to the study of the question, and who have capital to carry out much financially unprofitable work. It is not advisable, then, for farmers to attempt, at present, to raise seed even from their best beets. Until the business of raising beets for sugar finds a home here, and we have become skillful in this branch of agriculture, we must depend for our seed on the seed growers of Germany and France.

Notwithstanding this, and even if we never have another sugar factory in the state, it will be a paying investment for every farmer to raise one measured acre, at least, of beets, giving them the most careful and scientific cultivation possible.

ACKNOWLEDGMENTS.

In closing, we wish to acknowledge our obligations to the Burlington, Union Pacific, and the Elkhorn railroad companies, for their courteous co-operation which enabled us to reach parts of the state otherwise inaccessible to us; to the Oxnard Bros., for their kindness in adding to our stock of seed for free distribution; to the farmers of the state, and also to the field agents, Messrs. H. B. Duncanson, H. A. Senter, and Edward E. Nicholson, for their zeal and fidelity in carrying out their instructions even at the sacrifice of personal comfort.

SUMMARY.

1. These results are from experiments covering an area of over 75,000 square miles of territory.

2. Beets equally good for sugar-making purposes have been produced in all parts of the state.

*Analyse de la Question des Sucres, page 114.

3. Of the varieties grown this year the Klein Wanzlebener has given the best total results in the northern part of the state, Vilmorin was the best in the middle section, and Desprez gave the best results in the southern section.

4. The season has been the most trying one for the farmer that the state has known for ten years.

5. Beets in all parts of the state have suffered less than any other crop. Where grain and grass have been total failures from heat and drouth, beets have been fair in yield, rich in sugar, with a high purity coefficient.

6. Over five hundred farmers in the state sent beets, grown by them, for analysis. The result from these analyses ranged from 1 to 23.2 per cent sucrose.

7. To grow beets successfully, for sugar production, requires intensive farming.

8. To bring sugar capital into the state it is necessary to give satisfactory answers to the following questions:

a. Are our beets sufficiently rich in sugar?

b. How much does it cost the farmer to raise sugar beets?

c. What average tonnage yield can be safely counted on?

9. An affirmative answer has already been given by our investigations to the first question. The farmers themselves must answer the others. By following for two years the suggestions made in the body of this pamphlet in regard to growing measured plots of beets, results may be obtained that would ordinarily require ten years to reach.

10. Beet culture should not interfere with the growing of other crops; it should, by a proper system of rotation, increase the productiveness of the soil and enhance the value of all other farm products.

APPENDIX I.

1. We earnestly request the co-operation of all interested persons in the state.

2. A limited amount of seed is at our disposal, which will be distributed to those making application and sending stamps to prepay postage.

3. Blanks for reporting cost, yield, and cultivation may be had on application.

4. Beets will be analyzed, free of charge, when accompanied by report properly made out.

DIRECTIONS FOR SENDING BEETS.

I. Select half a dozen beets of each variety planted; two of the largest, two of medium or average size, and two of the smallest size.

II. Take beets from the ground without breaking the tap root.

III. Wrap each beet separately in strong manilla paper.

IV. Put the beets of each variety in a package by themselves, enclosing with them the report blank properly filled out, and send by express prepaid, or by mail, to H. H. Nicholson, Chemical Laboratory, State University, Lincoln.

☞ *Beets unaccompanied by report blank filled out as directed will not be analyzed.*

APPENDIX II.*

NEBRASKA STATE FAIR, LINCOLN, SEPTEMBER 4-11.

PREMIUMS, RULES, REGULATIONS, AND CONDITIONS.

With a view to encourage the general cultivation of sugar beets in Nebraska, for sugar making purposes, the Board offer the following premiums:

For the best one-quarter of an acre of sugar beets grown in Nebraska in the year 1891	$50 00
Second best	45 00
Third best	40 00
Fourth best	35 00
Fifth best	30 00
Sixth best	25 00
Seventh best	20 00
Eighth best	15 00
Ninth best	10 00

THE OXNARD BEET SUGAR COMPANY

will duplicate the above premiums, in cash, without discount. All other conditions and requirements are the same as for the regular premiums offered by the Board. Thus, the actual net cash premiums to winners will be:

For the first premium	$90 00
For the second premium	81 00
For the third premium	72 00
For the fourth premium	63 00
For the fifth premium	54 00
For the sixth premium	45 00
For the seventh premium	36 00
For the eighth premium	27 00
For the ninth premium	18 00

Still further, in addition, the Oxnard Sugar Beet Company will pay out of the state bounty, over and above the prices paid for sugar beets at its factory, or factories in the state of Nebraska, fifty cents per ton bounty on all beets it purchases and consumes, raised in the state in the year 1891. Also twenty per cent of the weight of beets purchased and consumed, in the shape of pulp, will be returned free to each party furnishing beets. Lime cakes, an excellent fertilizer, will be given free to farmers.

CONDITIONS.

Competitors are required to make entries with the Secretary of the State Board of Agriculture on or before date seed is received and planted—not later than May 1. On notice from the Director of the United States Experiment Station at Lin-

* Prospectus issued by Secretary of the State Board of Agriculture.

coln, competitors must carefully select, pack, and ship, prepaid, to said director at Lincoln six sample beets taken from the experiment one-quarter of one acre. At the same time, or by December 1 following, competitors must file with the State Board of Agriculture, and with the Director of the Experiment Station at Lincoln, on blanks to be furnished by the Secretary of the State Board, or by the Director of the Experiment Station, a statement of all facts as to kind of soil, depth of soil, date of planting, method of cultivation, in detail, number of pounds grown, date of harvesting, details as to fertilizer, if used, cost of producing, and such other information as might interest the public. All to be attested by two reliable witnesses. Beets sent for experiment not to exceed any considerable fraction over three pounds each in weight. (Large beets are objectionable as not producing satisfactory sugar results.) Competitors must exhibit not less than twelve specimens of beets produced, at the State Fair, Lincoln, September 4 to 11, 1891. Seeds sufficient to plant the experiment one-quarter of one acre—four pounds—will, if so desired, be furnished experimenters at actual cost, by the Secretary of the State Board of Agriculture, on application. Awards will be made at the Annual Winter Meeting of the State Board of Agriculture, held at Lincoln on the third Tuesday in January, 1892, and will be rendered on the official analysis of the United States Experiment Station at Lincoln, on the following scale of points, on the basis of 125 points.

SCORE OF 125 POINTS.	Score Points.	Points Off.
Lowest cost of production, the ¼ of an acre	25	
Largest yield, tonnage of beets, 3 lbs. and under, grown in the ¼ of an acre	25	
Largest content, or sugar per cent yield, of the 6 beets analyzed	50	
Compliance with rules and conditions governing these premiums	15	
Perfection of report as required	10	
Total points	125	
No. of points off		
Total score		

Beets weighing any considerable fraction over three pounds, or unaccompanied by the statement of facts aforementioned, will not be permitted to compete, and will not be analyzed.

GENERAL INSTRUCTIONS.*

It is of the greatest importance to work the soil in the cultivation and preparation for sugar beets only when it is dry. Plow from ten to twelve inches deep, harrow the soil until it is free from all lumps, and prepare it as you would for a vegetable garden. As soon as all danger of very heavy frost is over, roll the soil with a roller until you obtain a perfectly smooth surface. Then sow the seed with drills, at a distance from 16 to 18 inches apart between the rows, and at a depth of not more than one inch. Care should be taken not to sow deeper. As soon as the young plants appear in the rows, run a cultivator through the rows, or hoe if done by hand. When the young plants have four leaves they must be separated, leaving a single plant at distances from six to eight inches apart in the rows, according to the fertility of the soil. This work is of the greatest importance, for if delayed

* For full and detailed instructions as to culture, see page 260.

the effect will be to reduce the crop. After the plants have been separated, leaving only one plant every six or eight inches, hoe or cultivate two or three times, being careful to keep the crop free from weeds until the leaves by their foliage cover the ground, thus keeping the soil moist and preventing the weeds from growing. At this time the crop can be allowed to take its own course until harvest time. When the beets are ripe, they should be plowed out from the ground. Then with a sharp knife the leaves are cut off. The beets are then ready for delivery. The amount of sugar contained in the beets is due entirely to the care and cultivation given the crop at the proper time.

SEEDS FURNISHED.

Four pounds of seed are required to plant one-quarter of one acre. When the accompanying receipt and agreement are signed and returned to the Secretary, Robt. W. Furnas, Brownville, Nebraska, accompanied with 25 cents, four pounds of seed will be sent by express, the party receiving paying the express charges, 25 cents additional, when the seeds are received. If seeds are sent by mail, the receipt must be accompanied with 55 cents, when postage will be prepaid by Secretary sending, and the party will receive free. This receipt and remittance will be considered the entry as in competition for premiums as required in conditions relating thereto, and entry made accordingly.

FORM OF RECEIPT FOR SEEDS FURNISHED.

....1891.

Received from Robt. W. Furnas, Secretary of the Nebraska State Board of Agriculture, four pounds of sugar beet seed, which I agree to plant and experiment with, on one-quarter of one acre of land, under the rules and regulations as prescribed and furnished by the said State Board of Agriculture; that I will report, in full, the results of my experiment work as required by said State Board; that I will furnish for analysis the six beets as required, and also not less than twelve beets as required, to be exhibited at the State Fair at Lincoln, September 4 to 11, 1891.

NAME..
COUNTY..
P. O. ADDRESS..

FORM OF REPORT.

The following is the form of the report required to be furnished to the Secretary of the State Board, and to the Director of the Experiment Station on or before the 1st of December, 1891:

1. Variety of seed sown..
2. Date of planting..
3. Exact area of plat planted...
4. How deep was the ground plowed?..
5. Character of soil..
6. How much cultivation did the beets receive?.................................
7. Crop grown on ground the preceding year.......................................
8. Distance between rows...
9. Distance between beets in the row..

10. No. of pounds of beets under three pounds in weight raised on this plat.........
11. Entire cost...
12. Date of harvesting...
13. What fertilizer, if any, used?...
14. Do you think, from your experience of this year, that you could afford to grow beets at $4 per ton?...

Add such additional information as you deem advisable, and you think will be of interest.

The object of the State Board being to obtain all possible data and information concerning the new industry, cultivation, and manufacture of sugar beets, premiums are large, offering sufficient inducement for careful and thorough work and experimentation. To this end, strict compliance with conditions will be required. Blank forms of reports and receipts will be furnished on application to the Secretary.

J. JENSEN, *President*,
Geneva.

ROBT. W. FURNAS, *Secretary*,
Brownville.


MAP OF
NEBRASKA
SHOWING DISTRIBUTION OF
BEET CULTURE EXPERIMENTS
FOR
1890
KNOX
CEDAR
DIXON
DAKOTA
NIOBRARA
CREIGHTON
PIERCE
WAYNE
THURSTON
PENDER
BANCROFT
HOSKINS
NORFOLK
BILGER
MADISON
STANTON
CUMING
BURT
OAKLAND
WEST POINT
HOWELLS
PLATTE
COLFAX
DODGE
BLAIR
WASHINGTON
PLATTE CENTRE
GENOA
BUTLER
SAUNDERS
DOUGLAS
OMAHA
POLK
STROMSBURG
DAVID CITY
ASHLAND
SARPY
PAPILLION
AURORA
YORK
UTICA
GERMANTOWN
SEWARD
LANCASTER
CASS
UNION
WABASH
HAMILTON
LINCOLN
OTOE
BEAVER CROSSING
CRETE
SALINE
GENEVA
FILLMORE
CLAY
FAIRFIELD
EDGAR
BEATRICE
JOHNSON
NEMAHA
TECUMSEH
BELVIDERE
NUCKOLLS
THAYER
FAIRBURY
JEFFERSON
GAGE
PAWNEE
RICHARDSON
SUPERIOR
HUBBELL
ENDICOTT
ODELL
PAWNEE CITY
FALLS CITY
MISSOURI RIVER
PLATTE RIVER
SIOUX CITY & PACIFIC R.R.
MAPLE RIVER R.R.
CHIC. & N. W. R.R.
CHIC. ROCK ISLAND & PAC.
N. CY. & N. E.
ST. JOSEPH & COUNCIL
MO. PAC. R.R.
B. & M. R.R.
MO.

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